A-3. TABLES FOR BIRDS

******* GREAT BLUE HERON *******

***** NORMALIZING AND CONTACT RATE FACTORS *****

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
BODY WEIGHT													
Alexander 1977	A	B	-	-	2,400		g			72	nc lower Michigan	lakes, streams	Year of collection not specified.
Bayer 1981b	J	-	1	SU	1,820	300 SD	g	1,370	2,160	6	c Oregon 1974-80	estuary	Weights of herons found alive or dead but not decomposed. Juveniles found in (1) July; (2) August - December. Y = yearlings; they were collected from June - January.
	J	-	2	-	1,990	550 SD	g	1,370	2,750	8			
	Y	-	-	-	2,340	490 SD	g	1,940	2,970	5			
	A	-	-	WI	2,090		g			1			
Hartman 1961	A	F	-	-	2,204	337 SD	g			15	NS	NS	As cited in Dunning 1984.
	A	M	-	-	2,576	299 SD	g			17			
Hoffman 1978	A	B	-	SU	2,200		g			42	nw Ohio 1972-73	sw Lake Erie	
Poole 1938	-	-	-	-	1,905		g			1	NS	NS	
Quinney 1982	A	B	-	-	2,229	762 SD	g			37	e North America	NS	Based on records from museum collections.
NESTLING WEIGHT													
McAloney 1973	N	B	-	-	86		g day 1			4	Nova Scotia, CAN 1971	islands	Number of days in the units column is the age of the nestlings.
	N	B	-	-	170		g day 5			5			
	N	B	-	-	567		g day 10			8			
	N	B	-	-	983		g day 15			6			
	N	B	-	-	1,115		g day 20			5			
	N	B	-	-	1,441		g day 25			6			
	N	B	-	-	1,593		g day 30			7			
	N	B	-	-	1,786		g day 35			5			
	N	B	-	-	2,055		g day 40			4			
METABOLIC RATE (OXYGEN)													
Benedict & Fox 1927	-	-	-	-	14.6		lO2/kg-d				NS	NS	As cited in Altman and Dittmer 1968.

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
FOOD INGESTION RATE													
Alexander 1977	A	B	-	-	0.33		g/g-day				nc lower Michigan	lakes, streams	Estimate used by author to calculate effects of heron predation on fish.
Kushlan 1978	A	B	-	-	0.18		g/g-day				NS	NS	Estimate of food consumption calculated using Kushlan's equation for wading birds: log y = 0.966 log x - 0.640 where y = food consumption (g/day) and x = weight of bird (g). Value presented here based on heron weight of 2,230 g. Regression equation was derived from seven wading bird species.

***** DIET *****

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Alexander 1977	B	B	trout		88			15	nc lower Michigan	streams - % wet weight; stomach contents	Collections made during spring, summer, and fall. Most fish were 8 to 23 cm long.
			non-trout fish		2						
			crustaceans		1						
			amphibians		1						
			insects		4						
			birds and mammals		2						
			vegetation		1						
			unidentified		1						
Alexander 1977	B	B	trout		59			19	nc lower Michigan	lake - % wet weight; stomach contents	Collections made spring, summer, and fall. Most fish were between 20 and 28 cm long.
			non-trout fish		39						
			crustaceans		1						
			amphibians		1						
Alexander 1977	B	B	trout		89			38	nc lower Michigan	river - % wet weight; stomach contents	Collections made spring, summer, and fall. Most fish were 8 to 33 cm long.
			non-trout fish		5						
			crustaceans		1						
			amphibians		4						
			birds and mammals		1						
Collazo 1985	B	B	fish		67.5			1,535	n Idaho 1977-78	lakes in park - % biomass; boluses, regurgitated pellets, and fish remains below nests	Bolus = food regurgitated by nestlings. Months of collection = March - August. N = number of items identified. Average of two years; invertebrates (mainly aquatic arthropods) may be under-represented due to their high digestibility.
			(brown bullhead)		(32.5)						
			(tench)		(20.5)						
			(yellow perch)		(1.5)						
			(pumpkinseeds)		(3.0)						
			meadow vole		32.5						

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Cottam & Uhler 1945 (herodias & wardi)	-	-	non-game fish		43.2			189	throughout US	NS - % (measure NS); stomach contents	Season and basis for determining percentage unknown. As cited in Palmer 1962.
			valuable fish		24.8						
			unidentified fish		3.6						
			aquatic insects		8.2						
			crustaceans		8.9						
			herpetofauna		4.3						
			mice & shrews		4.7						
			misc. & plant		2.5						
Cottam & Williams 1939	-	-	fish		75.8			6	Vermont	marsh - % (measure NS); stomach contents	As cited in Palmer 1962.
			aquatic beetles		1.7						
			aquatic plants		22.5						
Hoffman 1978	B	B	Cyprinidae (carp, minnows, goldfish)		53.8			31	nw Ohio 1972-73	sw Lake Erie - % frequency of occurrence; stomachs	Mean of values for two heronries; N = total number of stomachs examined. Season = March - September.
			Centrarchidae (sunfish, crappie, large-mouth bass)		9.5						
			Sciaenidae		3.5						
			Percidae (perch)		10.1						
			Amiidae		6.5						
			Astacidae (crayfish)		31.3						
			Insecta		28.4						
Hoffman 1978	J	B	Cyprinidae (carp, minnows, goldfish)		50.0			166	nw Ohio 1972-73	sw Lake Erie - % frequency of occurrence; boluses regurgitated by nestlings	Mean of values for two heronries; N = total number of boluses examined (June - August). Items found in less than 1% of samples not included here.
			Ictaluridae		4.6						
			Clupeidae (gizzard shad, alewife)		5.0						
			Sciaenidae		10.1						
			Percidae (perch)		27.9						
			Centrarchidae (sunfish, crappies, black bass)		6.6						
			Astacidae		4.8						
Kirkpatrick 1940	J	B	crayfish		6			297	ne Wisconsin 1940	lakes - number of prey items; regurgitated by nestlings	Collected from June 28 - August 7. Species found 1 or 2 times not presented here. Number of fish = both whole fish and fragments. Size of whole fish and fragments ranged from 6 to 41 cm; most were between 6 and 23 cm.
			dragonfly		3						
			leopard frog		12						
			yellow perch		154						
			yellow pike-perch		21						
			northern rock bass		20						
			common white sucker		17						
			northern pike		14						
			large-mouthed bass		11						
			nort. black bullhead		9						
			bluegill		9						
			pumpkinseed		7						
			black crappie		4						

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Krebs 1974	A	B	staghorn sculpin					78	Br. Columbia, CAN 1972	coastal island - % of number of fish captured; observations	Other includes shiner sea perch and penpoint gunnels. Small = less than 1/3 beak length; medium = about 1/2 beak length; large = greater than beak length.
			small		27.8						
			medium		7.6						
			large		2.2						
			starry flounder								
			small		15.0						
			medium		8.1						
			large		5.2						
			other (see note)								
			small		30.6						
			medium		3.5						
Peifer 1979	A	M	bullhead		200+			4	c Minnesota 1977	lakes, uplands - number of prey items; observed eaten	Number of prey captured during observations of 4 radiotagged herons from April 7 - July 22.
			sunfish		10						
			13-lined ground squirrel		36						
			eastern chipmunk		5						
			prair. pocket gopher		5						
			eastern fox squirrel		1						
			eastern cottontail		1						
			leopard frog		8						
			grasshoppers		10+						
Quinney 1982	N	B	Atlantic silverside		3.6				Nova Scotia, CAN 1977-78	Boot island - % wet weight; items regurgitated by nestlings	Dates = May 15 to July 15. Percent wet weight calculated from % of total items collected and mean wet weights of items.
			mummichog		2.4						
			American eel		52.6						
			Gaspereaux		29.9						
			pollock		8.9						
			yellow perch		2.6						

***** POPULATION DYNAMICS *****

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
FEEDING TERRITORY SIZE													
Bayer 1978	A	B	1	FA	0.129	0.028	SD km			7	Oregon 1972	freshwater marsh	Average length (1) and area (2) of area defended by one birds foraging territory.
	A	B	2	FA	0.6	0.1	SD ha			7			
Bayer 1978	A	B	1	WI	0.355	0.168	SD km			32	Oregon 1973-76	estuary	Average shoreline length (1) and area (2) of intertidal area defended as foraging territory by one bird. Territories were largest in the winter.
	A	B	2	WI	8.4	5.4	SD ha			32			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Peifer 1979	A	M	-	SU	0.98		km	0.60	1.37	4	c Minnesota 1977	lakes	Length of shoreline actively defended as foraging territory by radiotagged herons (April 7 - July 22). Two of the herons also foraged for small mammals in upland areas.
DISTANCE FROM HERONRY TO FORAGING GROUNDS													
Collazo 1981	A	B	-	SU			km	0.4-0.7			Idaho 1977-78	lake, mountain ridge	Distance from heronry to nearest feeding grounds.
Dowd & Flake 1985	A	B	-	SU	3.1		km		24.4		S Dakota 1980-81	river & tributaries	Conservative estimate of average and maximum distances flown from colony to foraging sites during the breeding season.
English 1978	A	B	-	-	-		-				Oregon 1975	Willamette River	Of 31 heronries, 24 were located within 100 meters of known feeding areas.
Mathisen & Richards 1978	A	B	-	SU	1.8		km	0	4.2		Minnesota	Chippewa National Forest	The average distance of heronries to possible feeding areas (i.e., lakes greater than 40 ha in size). As cited by Short and Cooper 1985.
Parnell & Soots 1978	A	B	-	SU	7 - 8		km				North Carolina	coastal	Most heronries along the North Carolina coast were located near inlets, which tend to have large concentrations of fish. The average distance from the heronries to the inlets was 7.0 - 8.0 km. As cited by Short and Cooper 1985.
Peifer 1979	A	M	-	SU			km	13.7	34.1	4	c Minnesota 1977	lakes, uplands	Distance of actively defended foraging territories from colony - radiotagged herons (April 7 - July 22). Other (non-defended) areas used for feeding, including uplands, were between 4-20 km of the colony (heronry).
Thompson 1978	A	B	-	-	6.5		km		20.4		NS	upper Mississippi R.	Average flight distances (probably foraging) of breeding herons. As cited in Dowd and Flake 1985.

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
POPULATION DENSITY													
Dowd & Flake 1985	B	B	1	SU	2.3		N/km				N Dakota 1980-81	river & tributaries	Density of foraging herons based on censuses along water bodies; (1) stream with nearly continuous pools but little or no flow - 14 km sampled, almost half of the herons found were within 4 km of the heronry; (2) James River - sampled 12 km in each direction away from colony, 57% of herons found within 4 km.
	B	B	2	SU	3.6		N/km						
Gibbs et al. 1987	-	-	-	SU	149	53.4 SD	nests/ha			11	Maine 1983	marine islands	Mean nest density for 11 colonies. Colonies usually occupied a small area in the interior of the island.
Werschkul et al. 1977	-	-	-	SU	461		nests/ha	447	475	2	w Oregon 1974	coastal island	Density of nests within colonies.
Werschkul et al. 1977	-	-	-	SU	160	123 SD	nests/ha	15	358	6	w Oregon 1974	coastal canyon	Density of nests within colonies.
Werschkul et al. 1977	-	-	-	SU	169		nests/ha	68	269	2	w Oregon 1974	coastal flat	Density of nests within colonies.
CLUTCH SIZE													
Baird et al. 1884	-	-	-	-	3						Florida	NS	As cited in Palmer 1962.
McAloney 1973	-	-	-	-	4.17	0.85 SD		3	6	36	Nova Scotia, CAN 1971	island	
Miller 1943	-	-	-	-	4.37			3	6	347	Pennsylvania	NS	As cited in Palmer 1962.
Mitchell 1981	-	-	-	-	3.58						Texas 1981	NS	As cited in Pratt and Winkler 1985.
Page 1970	-	-	-	-	3.6						California	NS	As cited in Pratt 1972.
Palmer 1962	-	-	-	-	4 +/-			3	7		NS	NS	
Powell & Powell 1986	-	-	1	-	2.9	0.6 SD				64	s Florida	bay	(1-3) For 1981 to 1984: (1) Unsupplemented colonies; (2) supplemented colonies (fed by nearby residents); (3) identified supplemented nests. (4) 1923 data (prior to human disturbances).
	-	-	2	-	3.2	0.7 SD				82			
	-	-	3	-	3.6	0.8 SD				32			
	-	-	4	-	3.8	0.4 SD				11			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Pratt 1972	-	-	-	-	3.6					53	c California 1967-70	coastal canyon	
Pratt & Winkler 1985	-	-	-	-	3.16	0.04 SE		1	5	297	c California 1967-79	coastal canyon	Yearly means ranged from 2.72 (1971) to 3.35 (1968).
Quinney 1982	-	-	1	-	4.6					42	Nova Scotia, CAN 1977-78	Boot Island	Year: (1) 1977; (2) 1978.
	-	-	2	-	5.0					26			
Vermeer 1969	-	-	-	-	5.0					11	s Alberta, CAN 1967-68	Dowling Lake	As cited in Pratt 1972 and English 1978.
CLUTCHES/YEAR													
English 1978	-	-	-	-	1		/yr				nw Oregon 1975	river	Renesting was not observed in undisturbed populations, but groups did lay new clutches after their original nesting trees were cut down.
Miller 1943	-	-	-	-	1		/yr				Pennsylvania	NS	May replace clutch if eggs are lost, but will raise only one brood. As cited in Henny 1972.
DAYS INCUBATION													
Bent 1926	-	-	-	-	28		days				United States	NS	
McAloney 1973	-	-	-	-	27.1		days	25	30	11	Nova Scotia, CAN 1971	island	Time from laying last egg to hatching of last egg.
Quinney 1982	N	B	-	-	200		g day 5				Nova Scotia, CAN 1977-78	Boot Island	Number of days in the units column is the age of the nestlings. Estimated from figure; average of 9 and 16 nestlings measured at each age in 1977 and ’78 respectively. Regression equation for 1977: (weight) = 50.76 (age) - 37.2. For 1978: (weight) = 55.6 (age) - 47.4. Weight is in grams and age in days.
	N	B	-	-	500		g day 10						
	N	B	-	-	800		g day 15						
	N	B	-	-	1000		g day 20						
	N	B	-	-	1300		g day 25						
	N	B	-	-	1500		g day 30						
AGE AT FLEDGING													
Hancock & Kushlan 1984	-	-	-	-	60		days				NS	NS	

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
McAloney 1973	-	-	-	-	45		days				Nova Scotia, CAN 1971	island	Observed around the colony being fed by adults for another 10 days after leaving the nest at 45 days.
Quinney 1982	-	-	-	-	49 - 56		days				Nova Scotia, CAN 1977-78	Boot Island	Attained 86% of adult weight by 44 days.
N FLEDGE/ACTIVE NEST													
English 1978	-	-	-	-	1.96		N/pair			27	nw Oregon 1975	river	Windsor Island heronry.
Pratt 1972	-	-	-	-	1.7		N/pair	0	4		c California 1967-69	coastal canyon	Number fledged per pair; no pair raised more than one brood but many replaced lost clutches.
Pratt & Winkler 1985	-	-	-	-	1.45	0.06 SE	N/act nest	0.85	2.38	297	c California 1967-79	coastal canyon	Minimum and maximum are yearly means.
Quinney 1982	-	-	1	-	2.6		N/pair			42	Nova Scotia, CAN 1977-78	Boot Island	Fledging success in two different years: (1) 1977, (2) 1978; (3) = weighted average for both years. 1978.
	-	-	2	-	3.1		N/pair			26			
	-	-	3	-	2.8		N/pair			68			
McAloney 1973	-	-	-	-	2.84		N/pair			42	Nova Scotia, CAN, 1971	island	
N FLEDGE/SUCCESSFUL NEST													
Collazo 1981	-	-	-	-	2.17		N/suc nest	2.14	2.20		Idaho 1977-78	lake, mountain ridge	Average value of total of 257 nests over two years. Minimum and maximum = value for one of the years. Overall, 1.95 were fledged per pair.
English 1978	-	-	-	-	2.43		N/suc nest			107	nw Oregon 1975	river	Value for seven heronries combined.
Forbes et al. 1985	-	-	-	-	2.5	0.1 SE	N/suc nest	2.2	2.8	917	sw Brit. Col., CAN 1977-81	NS	Minimum and maximum are yearly means.
Henny & Bethers 1971	-	-	-	-	2.61		N/suc nest				w Oregon 1970	NS	As cited in McAloney 1973.
Kelsall & Simpson 1979	-	-	-	-	2.3 -2.9		N/suc nest				Brit. Col., CAN 1977-79	NS	As cited in Pratt & Winkler 1985.
McAloney 1973	-	-	-	-	3.09		N/suc nest			35	Nova Scotia, CAN 1971	island	

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Powell & Powell 1986	-	-	1	-	1.5	0.6 SD	N/suc nest			97	s Florida	bay	(1-3) for 1981 to 1984: (1) Unsupplemented colonies; (2) supplemented colonies (fed by nearby residents); (3) = identified supplemented nests. (4) = 1923 data (prior to human disturbances).
	-	-	2	-	1.9	0.7 SD	N/suc nest			101			
	-	-	3	-	2.5	0.7 SD	N/suc nest			41			
	-	-	4	-	2.6	0.7 SD	N/suc nest			22			
Pratt 1972	-	-	-	-	2.1		N/suc nest	1	4		c California 1967-70	coastal canyon	
Pratt & Winkler 1985	-	-	-	-	2.19	0.25 SD	N/suc nest	2	3	196	c California 1967-79	coastal canyon	Average of 13 yearly means; highest mean was 2.64, lowest was 1.87.
Vermeer 1969	-	-	-	-	2.2-2.5		N/suc nest				s Alberta, CAN 1967-68	NS	As cited in Pratt and Winkler 1985.
Werschkul et al. 1977	-	-	-	-	2.44		N/suc nest	2.18	2.70		Oregon 1974	coastal, 5 sites	Minimum and maximum of five site averages also listed.
PERCENT NESTS SUCCESSFUL													
English 1978	-	-	-	-	85		%/year				nw Oregon 1975	river	Percent fledging at least one young.
Forbes et al. 1985	-	-	-	-	92		%/year				se Brit. Col, CAN 1981-83	NS	
McAloney 1973	-	-	-	-	81		%/year	42			Nova Scotia, CAN 1971	island	Percent fledging at least one young.
Pratt & Winkler 1985	-	-	-	-	68		%/year	38	90	13	c California 1967-79	coastal canyon	Average value for 13 years of percent of nests fledging at least one young.
Pratt 1972	-	-	-	-	71		%/year	56	87		c California 1967-70	coastal canyon	
AGE AT SEXUAL MATURITY													
Bent 1926	-	B	-	-	2		years				NS	NS	Herons are "ready to breed" after their second winter.

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
ANNUAL MORTALITY													
Bayer 1981a	J	B	-	-	35		%/1st yr				nw US 1925-68	National Wildlife Refuges (NWRs)	Determined from life tables generated using banding data; birds banded as nestlings on NWRs from 1925-68.
	A	B	-	-	37		%/2nd yr						
	A	B	-	-	22		%/3rd+ yrs						
Bayer 1981a	J	B	-	-	69		%/1st yr				n US 1925-68	all areas except for National Wildlife Refuges	Determined from life tables generated using banding data; birds banded as nestlings from 1925-68.
	A	B	-	-	39		%/2nd yr						
	A	B	-	-	22		%/3rd+ yrs						
Collazo 1981	N	B	-	-	19		% nestling				Idaho 1977-78	lake, mountain ridge	Percent nestling mortality.
Henny 1972	J	B	-	-	64		%/1st yr				US & Canada 1946-65	NS	Values estimated by composite dynamic method based on recoveries of birds banded from 1946-65.
	A	B	-	-	36		%/2nd yr						
	A	B	-	-	22		%/3rd+ yr						
McAloney 1973	N	B	-	-	8.5		%/ 45 days			118	Nova Scotia, CAN 1971	island	Percent mortality by 45 days of age.
Owen 1959	J	-	-	-	71		%/1st yr				US 1916-1945	NS	Estimate for birds banded between 1916 and 1945; as cited in Henny 1972.
	A	-	-	-	29		%/2nd+ yr						

***** SEASONAL ACTIVITIES *****

Reference	Begin	Peak	End	Location	Habitat	Notes
MATING/LAYING						
Collazo 1981	mid Mar			Idaho 1977-78	lake, mountain ridge	
English 1978	mid Mar			nw Oregon 1975	river	
Howell 1932	Nov-Dec		Apr	Florida	NS	As cited in Palmer 1962.
McAloney 1973	mid Apr	earl May	late May	Nova Scotia, CAN 1971	island	
Miller 1943	late Mar		earl Apr	Pennsylvania	NS	As cited in Palmer 1962.
Palmer 1949		late Apr		Maine	NS	As cited in Palmer 1962.
Pratt & Winkler 1985	mid Feb	mid Mar	June	c California 1967-79	coastal canyon	
Wood 1951		Apr		Michigan	NS	As cited in Palmer 1962.

Reference	Begin	Peak	End	Location	Habitat	Notes
HATCHING						
Collazo 1981	mid Apr			Idaho 1977-78	lakes, mountain ridge	
English 1978		earl May		nw Oregon 1975	river	
Hoffman & Curnow 1979	mid May		mid Jul	Ohio 1973	sw Lake Erie	
Werschkul et al. 1977	late Mar	earl May		w Oregon 1974	coastal	
FLEDGING						
Collazo 1981			mid Aug	Idaho 1977-78	lakes, mountain ridge	
English 1978		earl Jul		nw Oregon 1975	river	
Hoffman & Curnow 1979	mid July		mid Sept	Ohio 1973	sw Lake Erie	
Werschkul et al. 1977		Jul		w Oregon 1974	coastal	
FALL MIGRATION						
Bent 1926			mid Oct	Nova Scotia & Manit., CAN	NS	Late date of departure.
Bent 1926			late Oct	Wisconsin	NS	Late date of departure.
Bent 1926			mid Nov	Illinois	NS	Late date of departure.
Hoffman & Curnow 1979		Oct		Ohio 1973	sw Lake Erie	Departure following breeding season.
Palmer 1962	mid Sep		late Oct	northern US	NS	
SPRING MIGRATION						
Bent 1926	mid Feb			Illinois	NS	Early date of arrival.
Bent 1926	late Mar			Nova Scotia, CAN	NS	Early date of arrival.
Bent 1926	mid Mar			Wisconsin & Minnesota	NS	Early date of arrival.

Reference	Begin	Peak	End	Location	Habitat	Notes
Bent 1926	mid Apr			Manitoba, CAN	NS	Early date of arrival.
Collazo 1981	late Feb			Idaho 1977-78	lakes, mountain ridge	First observation of herons on breeding grounds.
Hoffman & Curnow 1979		Mar		Ohio 1973	sw Lake Erie	Arrival for breeding season.
Werschkul et al. 1977	mid Feb		mid Mar	w Oregon 1974	coastal	Arrival at breeding grounds.

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
BODY WEIGHT													
Nelson & Martin 1953 (canandensis)	A	M	-	-	3,800		g		6,300	232	United States	NS	Data from USFWS records (from bird banders, game bag investigations).
	A	F	-	-	3,300		g		5,900	159			
Webster (unpubl.) (canandensis)	A	M	-	-	3,992		g			4,175	NS	NS	As cited in Bellrose 1976.
	A	F	-	-	3,447		g			3,452			
	J	M	-	-	3,402		g			3,406			
	J	F	-	-	3,084		g			3,444			
Ratti et al. 1977 (fulva)	A	F	-	SU	3,043		g +/- 46			134	se Alaska 1973	Glacier Bay	Molting geese captured in July. Values after the +/- in the units column are 95% confidence limits.
	A	M	-	SU	3,690		g +/- 41			175			
Nelson & Martin 1953 (hutchinsii)	A	F	-	-	1,900		g		2,400	37	United States	NS	Data from USFWS records (from bird banders, game bag investigations).
	A	M	-	-	2,000		g		2,700	31			
Estel 1983 (interior)	A	M	-	FA	4,058		g			66	Ilinois	lakes in refuges	Fall weights are from October through November; Winter are from December to mid February (pre-migration).
	A	M	-	WI	4,173		g			235	1982-83		
	A	F	-	FA	3,575		g			74			
	A	F	-	WI	3,652		g			323			
Estel 1983 (interior)	J	M	-	FA	3,567		g			98	Illinois	lake	Fall weights are from October - November; winter weights are from December - mid February (pre-migration).
	J	M	-	WI	3,817		g			453	1982-83		
	J	F	-	FA	3,152		g			90			
	J	F	-	WI	3,345		g			421			
Raveling 1968 (interior)	A	M	-	FA	4,212	35 SE	g	3,799	4,727	44	Illinois	orchard, lake	Collected from October 12-24 (fall), November 16-December 9 (winter), and February 10 - March 9 (spring). Juveniles = young of the year. Data also provided for yearlings, but sample sizes were small (6-16); means for yearlings were always larger than juveniles and smaller than adults for the same sex and season.
	J	M	-	FA	3,645	24 SE	g	3,317	3,884	40	1964-65		
	A	F	-	FA	3,550	31 SE	g	3,147	3,856	45			
	J	F	-	FA	3,067	39 SE	g	2,523	3,629	57			
	A	M	-	WI	4,215	36 SE	g	3,827	4,621	39			
	J	M	-	WI	3,642	29 SE	g	3,317	4,026	46			
	A	F	-	WI	3,573	45 SE	g	3,119	3,827	32			
	J	F	-	WI	3,122	36 SE	g	2,580	3,544	49			
	A	M	-	SP	4,122	31 SE	g	3,856	4,649	45			
	J	M	-	SP	3,582	44 SE	g	3,204	3,941	25			
	A	F	-	SP	3,433	31 SE	g	3,062	3,912	44			
	J	F	-	SP	3,132	31 SE	g	2,778	3,430	33			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Thornburg et al. 1988 (interior)	B	B	1	FA	3,613	35 SE	g			187	s Illinois 1982-83	lakes in refuge	Months of weighing: (1) Oct - early Nov; (2) Nov - mid Dec; (3) mid Dec - Jan; (4) Jan - early Feb; (5) Feb - early March. Late winter and spring means were significantly lower the next year (3,628 and 3,227 respectively) - authors suggest this was due to severe winter weather and food shortages.
	B	B	2	FA	3,686	54 SE	g			139			
	B	B	3	WI	3,741	42 SE	g			118			
	B	B	4	WI	3,917	31 SE	g			258			
	B	B	5	SP	3,741	19 SE	g			640			
Johnson et al. 1979 (leucopareia)	-	M	-	SU	1,946	136 SD	g				Alaska	Buldir Island	
	-	F	-	SU	1,703	155 SD	g						
Johnson et al. 1979 (leucopareia)	-	M	-	SP	2,110	224 SD	g				California	NS	
	-	F	-	SP	1,863	193 SD	g						
Brakhage 1965 (maxima)	A	M	-	SU	4,960		g			66	Missouri 1963	reservoir, marsh	Resident geese weighed during molting period. Y = yearling.
	Y	M	-	SU	4,760		g			31			
	A	F	-	SU	4,160		g			83			
	Y	F	-	SU	4,140		g			38			
Hanson 1965 (maxima)	A	M	-	-	5,670		g			28	NS	NS	As cited in Bellrose 1976.
	A	F	-	-	5,035		g			25			
	J	M	-	-	4,808		g			29			
	J	F	-	-	4,037		g			15			
Mainguy & Thomas 1985 (maxima)	A	F	L	SP	5,385	59 SE	g			55	Ontario, CAN 1980-81	fields, farms	Breeding condition: L = beginning of laying; I = post-laying (incubating); P = post incubation; M = molting. Non-migratory population.
	A	F	I	SP	3,916	58 SE	g			41			
	A	F	P	SP	3,163	66 SE	g			10			
	A	F	M	SU	3,558	68 SE	g			15			
McLandress & Raveling 1981 (maxima)	A	F	MI	SP	4,040		g			104	Minnesota 1974	lake	Weighed from early February to early March (prior to migration).
	A	M	MI	SP	4,740		g			99			
McLandress & Raveling 1981 (maxima)	J	M	-	SP	4,080		g			42	Minnesota 1974	lake	Prior to migration (early February to early April). Y = yearlings (between 1 and 2 years old).
	J	F	-	SP	3,550		g			44			
	Y	M	-	SP	4,330		g	3,610	5,180	11			
	Y	F	-	SP	3,670		g			19			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
McLandress & Raveling 1981 (maxima)	A	F	1	WI	3,712		g	3,252	4,117	5	Minnesota 1974	fields near lake	Prior to migration to breeding grounds, geese put on weight quickly. Collection dates: (1) February 12-16; (2) March 4-7; (3) March 14-16; (4) April 4-6.
	A	F	2	SP	3,942		g	3,845	4,160	4			
	A	F	3	SP	4,381		g	4,009	4,901	6			
	A	F	4	SP	5,033		g	4,725	5,243	4			
	A	M	1	WI	4,149		g	3,968	4,433	3			
	A	M	2	SP	4,883		g	4,535	5,128	5			
	A	M	3	SP	5,200		g	5,134	5,266	2			
	A	M	4	SP	5,574		g	5,424	5,725	2			
Johnson et al. 1979 (minima)	-	M	-	-	1,546	200 SD	g				Alaska	NS	
	-	F	-	-	1,312	200 SD	g						
Kortright 1942 (minima)	-	M	-	-	1,542		g			28	NS	NS	As cited in Bellrose 1976.
	-	F	-	-	1,270		g			17			
Nelson & Martin 1953 (minima)	A	M	-	-	2,000		g		2,500	30	United States	NS	Data from USFWS records (from bird banders, game bag investigations).
	A	F	-	-	1,400		g		2,300	20			
Raveling 1978a (minima)	J	M	-	FA	1,360	85 SD	g	1,180	1,510	13	California 1973-74	lakes in refuges	Fall geese collected in late October, winter geese collected in late December.
	J	M	-	WI	1,250	65 SD	g	1,150	1,310	5			
	J	F	-	FA	1,200	90 SD	g	1,070	1,350	18			
	J	F	-	WI	1,070	90 SD	g	940	1,210	8			
Raveling 1979 (minima)	A	M	1	FA	1,540	39 SE	g	1,380	1,705	9	California 1973-74	lakes in refuges	(1) Fall migration (Oct 23); (2) Dec 27; (3) spring migration (April 4-5).
	A	M	2	WI	1,398	33 SE	g	1,230	1,550	10			
	A	M	3	SP	1,487	53 SE	g	1,340	1,665	5			
	A	F	1	FA	1,287	53 SE	g	1,145	1,515	6			
	A	F	2	WI	1,205	33 SE	g	1,125	1,320	5			
	A	F	3	SP	1,295	47 SE	g	1,105	1,650	11			
Raveling 1979 (minima)	A	M	1	SP	1,530	37 SE	g	1,410	1,640	5	Alaska 1973-74	delta	(1) prelaying; (2) day their eggs hatched; (3) early molt.
	A	M	2	SU	1,460	52 SE	g	1,315	1,665	6			
	A	M	3	SU	1,443	32 SE	g	1,260	1,605	9			
	A	F	1	SP	1,387	61 SE	g	1,180	1,530	5			
	A	F	2	SU	1,095	37 SE	g	950	1,295	9			
	A	F	3	SU	1,362	54 SE	g	1,195	1,590	8			
Murphy & Boag 1989 (moffitti)	A	F	1	SP	3,817	229 SD	g			13	Alberta, CAN 1985-86	lakes	Incubation stage: (1) early; (2) late.
	A	F	2	SP	3,186	196.0 SD	g			12			
Nelson & Martin 1953 (moffitti)	A	M	-	-	4,600		g		5,700	9	United States	NS	Data from USFWS records (from bird banders, game bag investigations).
	A	F	-	-	3,500		g		4,300	6			
Yocom 1972 (moffitti)	B	M	-	FA	4,334		g			10	Washington 1940-51	Snake River area	Taken during hunting season.
	B	F	-	FA	3,930		g			9			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Chapman 1970 (occidentalis)	J	M	-	-	3,163	294 SD	g	2,840	3,664	8	Oregon 1966-67	NS	Banded near Copper River Delta, Alaska; shot in Oregon from late October - early January. Adult values include yearlings (3 males, 2 females).
	J	F	-	-	2,722	265 SD	g	2,300	3,096	7			
	A	M	-	-	3,814	542 SD	g	3,181	4,942	10			
	A	F	-	-	3,038	402 SD	g	2,755	3,749	5			
Chapman 1970 (occidentalis)	A	M	-	WI	3,712		g	2,925	4,317	69	Oregon 1965-66	NS	Average of means of geese collected during December 9-22 and December 23 - January 26.
	J	M	-	WI	3,408		g	2,386	4,260	96			
	A	F	-	WI	3,093		g	2,272	3,806	55			
	J	F	-	WI	2,906		g	2,102	3,522	79			
Chapman 1970 (occidentalis)	A	M	-	FA	3,636		g	2,868	4,459	65	Oregon 1965	NS	Average of means of geese collected during November 10 - 24 and November 25 - December 8.
	J	M	-	FA	3,253		g	1,931	4,658	340			
	A	F	-	FA	3,059		g	2,244	4,044	43			
	J	F	-	FA	2,812		g	1,874	3,635	287			
Johnson et al. 1979 (occidentalis)	-	M	-	-	3,233	261 SD	g				Alaska	NS	
	-	F	-	-	2,640	202 SD	g						
Grieb 1970 (parvipes)	A	M	-	WI	2,769	30 SE	g			184	se Colorado 1951-64	reservoirs, lakes	Primarily parvipes subspecies, but likely to include 5-10% hutchinsii as well.
	A	F	-	WI	2,472	23 SE	g			194			
	J	M	-	WI	2,481	43 SE	g			125			
	J	F	-	WI	2,185	29 SE	g			151			
Nelson & Martin 1953 (parvipes)	A	M	-	-	2,700		g		4,800	113	United States	NS	Data from USFWS records (from bird banders, game bag investigations).
	A	F	-	-	2,500		g		3,900	129			
Johnson et al. 1979 (taverneri)	-	M	-	-	2,606.5	267.4 SD	g				Alaska	NS	
	-	F	-	-	2,420.7	238.2 SD	g						
Yocom 1972 (taverneri)	B	M	-	FA	2,665		g	2,835	2,495	2	e Washington 1940-51	NS	Taken during hunting season.
	B	F	-	FA	2,154		g	1,928	2,604	4			
BODY FAT													
Williams & Kendeigh 1982 (interior)	A	F	1	FA	440		g			2	from s Illinois	captive	Month: (1) Oct-Dec; (2) Jan; (3) Apr; (4) May; (5) June; (6) July.
	A	F	2	WI	550		g			2			
	A	F	3	SP	750		g			1			
	A	F	4	SP	610		g			1			
	A	F	5	SU	570		g			1			
	A	F	6	SU	150		g			1			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Williams & Kendeigh 1982 (interior)	A	M	1	FA	550		g			2	from s Illinois	captive	Month: (1) Oct-Dec; (2) Feb; (3) Apr; (4) Jun; (5) July.
	A	M	2	WI	860		g			2			
	A	M	3	SP	930		g			2			
	A	M	4	SU	890		g			1			
	A	M	5	SU	330		g			1			
Mainguy & Thomas 1985 (maxima)	A	F	L	SP	726	27 SE	g			55	Ontario, CAN 1980-81	fields, farms	Breeding condition: L = beginning of laying; I = post laying (incubating); P = post incubation; M = molting. Non-migratory population.
	A	F	I	SP	563	26 SE	g			41			
	A	F	P	SP	166	18 SE	g			10			
	A	F	M	SP	436	43 SE	g			15			
McLandress & Raveling 1981 (maxima)	A	F	1	WI	642		g	433	854	5	Minnesota 1974	fields near lake	Prior to migration to breeding grounds, geese put on weight quickly. Collection dates: (1) February 12-16; (2) March 4-7; (3) March 14-16; (4) April 4-6.
	A	F	2	SP	619		g	433	925	4			
	A	F	3	SP	951		g	814	1,096	6			
	A	F	4	SP	1,442		g	1,303	1,577	4			
	A	M	1	WI	580		g	413	724	3			
	A	M	2	SP	639		g	375	948	5			
	A	M	3	SP	881		g	797	964	2			
	A	M	4	SP	1,253		g	1,133	1,372	2			
Peach & Thomas 1986 (maxima)	N	B	1	-	7.1	1.3 SD	g			14	Ontario, CAN 1983	lab	Total body lipids: Age: (1) at hatching; (2) 10 days; (3) 20 days; (4) 25 days.
	J	B	2	-	35	12 SD	g			14			
	J	B	3	-	160	41 SD	g			14			
	J	B	4	-	236	87 SD	g			13			
Thomas et al. 1983 (maxima)	A	F	1	SP	751	45 SE	g			34	Ontario, CAN 1981	captive	Non-migratory population from Toronto. Condition: (1) pre-laying; (2) post laying (incubating); (3) late incubation; (4) molting.
	A	F	2	SP	611	40 SE	g			29			
	A	F	3	SP	166	18 SE	g			10			
	A	F	4	SU	485	37 SE	g			21			
Raveling 1979 (minima)	A	M	1	FA	230	20 SE	g	129	292	9	California 1973-74	lakes in refuges	Total body lipid weight: (1) fall migration (Oct 23); (2) Dec 27; (3) spring migration (April 4-5).
	A	M	2	WI	70	8 SE	g	33	123	10			
	A	M	3	SP	205	19 SE	g	157	265	5			
Raveling 1979 (minima)	A	M	1	SP	56	26 SE	g	26	107	3	Alaska 1973-74	delta	Total body lipid weight: (1) Prelaying; (2) hatch day; (3) early molt.
	A	M	2	SU	53	9 SE	g	27	82	6			
	A	M	3	SU	93	11 SE	g	47	146	9			
Raveling 1979 (minima)	A	F	1	FA	182	24 SE	g	117	264	6	California 1973-74	lakes in refuges	Total body lipid weight: (1) fall migration (Oct 23); (2) Dec. 27; (3) spring migration (April 4-5).
	A	F	2	WI	57	6 SE	g	34	71	5			
	A	F	3	SP	172	25 SE	g	68	362	11			
Raveling 1979 (minima)	A	F	1	SP	171		g	136	205	2	Alaska 1973-74	delta	Total body lipid weight: (1) prelaying; (2) hatch day; (3) early molt.
	A	F	2	SU	33	5 SE	g	14	51	9			
	A	F	3	SU	108	13 SE	g	62	179	8			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Murphy & Boag 1989 (moffitti)	A	F	1	SP	511	127 SD	g			14	Alberta, CAN 1985-86	lake	Incubation state: (1) early; (2) late. Energy from fat catabolism supplied 83% of energy requirements during incubation.
	A	F	2	SP	66	32 SD	g			12			
EGG WEIGHT													
Owen 1980 (hutchinsii)	-	-	-	-	116		g				NS	NS	As cited by Dunn and MacInnes 1987.
Manning 1978 (interior)	-	-	-	-	150	1.7 SE	g			125	Ontario, CAN 1973	islands	Weighed at an average of 1.5 days after the start of incubation.
Owen 1980 (interior)	-	-	-	-	152		g				NS	NS	As cited by Dunn and MacInnes 1987.
Thomas & Peach Brown 1988 (interior)	-	-	-	-	161.2	14.1 SD	g			544	s Ontario, CAN 1979	lake	
Owen 1980 (leucopareia)	-	-	-	-	127		g				NS	NS	As cited in Dunn and MacInnes 1987.
Owen 1980 (minima)	-	-	-	-	96		g				NS	NS	As cited by Dunn and MacInnes 1987.
LeBlanc 1987a (moffitti)	-	-	-	-	163		g			564	Alberta, CAN 1983-84	lake	Weight of eggs varied by clutch size and by position in the laying order.
Owen 1980 (moffitti)	-	-	-	-	175		g				NS	NS	As cited by Dunn and MacInnes 1987.
Williams (unpubl.) (moffitti)	-	-	-	-	145		g				Utah	NS	Just after laying (i.e., before water loss). As cited in Palmer 1962, 1976.
Kortright 1942 (occidentalis)	-	-	-	-	161		g				NS	NS	As cited by Dunn and MacInnes 1987.
HATCHING WEIGHT													
Sedinger 1986 (minima)	H	M	-	-	61.8		g			4	Alaska 1978-79	coastal tundra	Males = 2 days old, female = 3 days old.
	H	F	-	-	61.4		g			1			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
LeBlanc 1987b (moffitti)	H	M	-	-	108.7		g			90	Alberta, CAN 1983-84	lake	Weight at hatching of birds from six egg clutches. Weights varied by number in clutch and by egg-laying order.
	H	F	-	-	109.5		g			85			
GOSLING WEIGHT													
Sedinger 1986 (minima)	J	F	-	-	150		g day 10				Alaska 1978-79	coastal tundra	Interpolated from graph of age vs. weight; N=27 total. Age (days) is in units column.
	J	F	-	-	450		g day 20						
	J	F	-	-	755		g day 30						
	J	F	-	-	950		g day 40						
	J	F	-	-	1,050		g day 47						
Sedinger 1986 (minima)	J	M	-	-	150		g 10 days				Alaska 1978-79	coastal tundra	Interpolated from graph of age vs. weight, N=25 total. Age (days) is in the units column.
	J	M	-	-	515		g 20 days						
	J	M	-	-	875		g 30 days						
	J	M	-	-	1,100		g 40 days						
	J	M	-	-	1,200		g 47 days						
Williams (unpubl.) (moffitti)	H	B	-	-	110		g day 0			13	NS	NS	Age (days) of goslings is in units column. As cited in Palmer 1976.
	J	B	-	-	240		g day 9			13			
	J	B	-	-	440		g day 16			13			
	J	B	-	-	1,400		g day 30			13			
	J	B	-	-	2,400		g day 44			13			
	J	B	-	-	2,600		g day 51			13			
GOSLING GROWTH RATE													
Williams (unpubl.) (moffitti)	J	-	-	-	50.5		g/day			13	NS	NS	From 1 to 51 days. As cited in Palmer 1976.
FLEDGING WEIGHT													
Sedinger 1986 (minima)	J	M	-	-	1,284	47.2 SE	g			3	Alaska 1978-79	coastal tundra	Males weight was 87% of adult weight, female was 89% of adult weight. Note that N is very small.
	J	F	-	-	1,228		g			1			
LeBlanc 1987b (moffitti)	J	M	-	-	2,360		g 50 days			28	Alberta, CAN 1983	lake	Near fledging (50 days old).
	J	M	-	-	2,030		g 50 days			17			
LEAN (DRY) BODY WEIGHT													
Peach & Thomas 1986 (maxima)	N	B	1		16	2.1 SD	g			14	Ontario, CAN 1983	lab	Age: (1) at hatching; (2) 10 days; (3) 20 days; (4) 25 days.
	J	B	2		76	16 SD	g			14			
	J	B	3		244	25 SD	g			14			
	J	B	4		338	58 SD	g			13			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
METABOLIC RATE (KCAL BASIS)													
Williams & Kendeigh 1982 (interior)	A	M	1	WI	105		kcal/kg-d				from s Illinois	lab	Existence metabolism at typical breeding ground (Ontario, CAN - spring and summer) and wintering ground (s Illinois - fall and winter) temperatures. Temperature (C) and weight of geese: (1) (December) 4.2 - 4.65 kg; (2) (May) 1.4 - 4.80 kg (average of April and June weight); (3) (July) 13.9 - 3.84 kg; (4) (Nov) 8.8 - 4.65 kg (Oct and Dec weight).
	A	M	2	SP	105		kcal/kg-d						
	A	M	3	SU	115		kcal/kg-d						
	A	M	4	FA	100		kcal/kg-d						
Williams & Kendeigh 1982 (interior)	A	F	1	SP	130		kcal/kg-d				from s Illinois	lab	Existence metabolism at typical breeding ground (Ontario, CAN - spring and summer) temperatures. Temperature (C) and weight of geese: (1) (May) 1.4 - 3.68 kg; (2) (July) 13.9 - 2.95 kg.
	A	F	2	SU	143		kcal/kg-d						
Williams & Kendeigh 1982 (interior)	A	M	1	WI			kcal/kg-d		209		from s Illinois	lab	Maximum free-living metabolism at typical breeding ground (Ontario, CAN - spring and summer) and wintering ground (s Illinois - fall and winter) temperatures. Temperature (C) and weight of geese: (1) (December) 4.2 - 4.65 kg; (2) (May) 1.4 - 4.80 kg (average of April and June weight); (3) (July) 13.9 - 3.84 kg; (4) (Nov) 8.8 - 4.65 kg (Oct and Dec weight).
	A	M	2	SP			kcal/kg-d		203				
	A	M	3	SU			kcal/kg-d		253				
	A	M	4	FA			kcal/kg-d		209				
Williams & Kendeigh 1982 (interior)	A	F	1	SP			kcal/kg-d		220		from s Illinois	lab	Maximum free-living metabolism at typical breeding ground (Ontario, CAN - spring and summer) temperatures. Temperature (C) and weight of geese: (1) (May) 1.4 - 3.68 kg; (2) (July) 13.9 - 2.95 kg.
	A	F	2	SU			kcal/kg-d		274				
FOOD INGESTION RATE													
Joyner et al. 1984 (interior)	A	M	-	WI	0.030		g/g-day			3	from Illinois 1982	captive	Original data in grams dry weight feed, corrected to grams wet weight feed. Feed (i.e., corn, sunflower, seeds, wheat, and milo) contained an average of only 11% moisture.
	A	F	-	WI	0.033		g/g-day			5			
	A	M	-	SP	0.030		g/g-day			3			
	A	F	-	SP	0.031		g/g-day			5			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Peach & Thomas 1986 (maxima)	N	B	1		49		g/day				Ontario, CAN 1983	lab	Age: (1) 5 days; (2) 10 days; (3) 15 days; (4) 20 days; (5) 25 days. From equation: gosling food consumption (g) = 8.36 x age (days) + 7.32.
	J	B	2		91		g/day						
	J	B	3		133		g/day						
	J	B	4		175		g/day						
	J	B	5		216		g/day						

***** DIET *****

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Buchsbaum et al. 1984	B	B	Zostera marina	27				1553	Massachusetts 1980-83	salt marsh - % frequency; plants observed eaten	Season = late spring and early summer. N = the total numbr of feeding observations. Available plants not eaten were Fucus vesiculosis, Limonium carolinium, Salicornia species, and Solidago semipervirens.
			Spartina alternifl. (tall)	18							
			Poa pratensis	15							
			Enteromorpha spp.	9							
			Juncus gerardi	9							
			Spartina alternifl. (short)	9							
			Spartina patens	8							
			Triglochin maritima	4							
			Iva frutescens	1							
			Phragmites communis	<0.1							
Craven & Hunt 1984	B	B	corn			23		90	ec Wisconsin 1979	marsh - % dry volume; gizzard & proventriculus	Calculated from volumes presented in paper. Only foods found in quantities of > 1ml dry volume were included.
			uniden. plant matter			8.6					
			alfalfa			10.4					
			Gramineae			12.6					
			oats			25.1					
			Setaria lutescens			8.4					
			Trifolium repens			10.9					
Korschgen 1955	-	-	wild millet		36			184	Missouri	NS - % (not specified); "stomach" contents	As cited in Bellrose 1976 (does not sum to 100%; season not specified).
			smartweed seeds		10.1						
			cut grasses		10.2						
			spike rushes		8.3						
			winter wheat		6.1						
			corn		5.5						
			nutgrasses		4.8						
			soybeans		3.2						

Reference	Age	Sex	Food type		Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Martin et al. 1951	A	B	sago pondweed	FW				25-50	45	w WA, w OR, CA	NS	Eating the vegetative part of the plant and any other part noted in parenthesis. The initial at the end of each plant notes what season that item was important. Geese caught in winter = 35; spring = 0; summer = 1; and fall = 9. Items comprising 2% or less not included here.
			barley (seed)	W				10-25			-	
			hardstem bulrush	FW				10-25			rough approx. of	
			wheat (seed)	W				5-10			% diet; "stomach"	
			wildbarley	W				5-10			contents	
			bromegrass	W				5-10				
			wild oats	W				2-5				
Martin et al. 1951	A	B	saltgrass	SuFW				10-25	183	w US, mostly Utah	NS	Eating the vegetative part of the plant and any other part noted in parenthesis. The initial at the end of each plant notes what season that item was important. Geese caught in winter = 92; spring = 0; summer = 19; and fall = 72. Items comprising 2% or less not included here.
			sago pondweed	SuFW				10-25			-	
			glasswort	FW				10-25			rough approx. of	
			wheat	SuW				5-10			% diet; "stomach"	
			bulrush (seed)	FW				5-10			contents	
			widgeongrass	SuFW				5-10				
			bromegrass	FW				2-5				
			wild barley	FW				2-5				
			rabbitfoot grass	SuFW				2-5				
			seepweed	FW				2-5				
			peppergrass	FW				2-5				
Martin et al. 1951	A	B	cordgrass					10-25	10	Gulf coast	NS	Eating the vegetative part of the plant and any other part noted in parenthesis. spring = 0; summer = 1; and fall = 9. Items comprising 2% or less not included here.
			saltgrass					5-10			-	
			glasswort					5-10			rough approx. of	
			bulrush (seeds)					5-10			% diet; "stomach"	
			bermuda grass					2-5			contents	
			naiad					2-5				
			lycium					2-5				
Martin et al. 1951	A	B	cordgrass	FW				25-50	45	Atlantic coast	NS	Eating the vegetative part of the plant and any other part noted in parenthesis. 44 birds caught in winter, 4 in fall. Items comprising 2% or less not included here. Initial after plant name denotes what season that food was important.
			widgeongrass	W				10-25			-	
			spikerush (seeds)	W				10-25			rough approx. of	
			sea lettuce	W				5-10			% diet; "stomach"	
											contents	
Yelverton & Quay 1959	B	B	sedges					63	294	NC 1951-52, 1953-54	lake	Sedges were roots, stems and seeds of spike rush and roots, rhizomes and seeds of American bulrush. From 263 gizzards and 31 crops collected during hunting season. As cited in Bellrose 1976 and Craven 1981.
			native grasses					11			-	
			corn kernels					22			% volume; crop	
			animal					0.01			and gizzard contents	
			other					4				

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Bell & Klimstra 1970 (interior)	B	B	Glycine max			34.5		561	s Illinois 1953-54	lakes in refuge - % volume; crop (wet/ dry NS)	Collected from November 1 to December 15. Plants comprising less than 2% combined into "other plants."
			Zea mays			25.6					
			Sorghum halpense			12.3					
			Polygonum pennsyl-vanicum			4.8					
			Taxodium distichum			3.0					
			Eleocharis acicularis			2.4					
			Lemna minor			2.0					
			other plants			11.5					
			animal			0.1					
			undetermined			3.8					
Prevett et al. 1985 (interior)	A	B	Equisetum sp. (shoot	9.2				124	Ontario, CAN 1976-80	bay - % dry weight; esophagus, gizzard & proventriculus	Migrant and local pre-nesting geese
			Triglochin palustris (root)	3.4							
			grasses (root)	23.4							
			(shoot)	2.1							
			sedges (shoot)	25.3							
			(root)	5.3							
			(reed)	17.9							
			Plantago maritima (root)	6.5							
			unident. plant	6.1							
			invertebrates	0.7							
McLandress & Raveling 1981 (maxima)	A	B	corn	13			50	8	Minnesota 1974	lake - % occurrence; esophagi, gizzards, and proventriculi	Sample size = 8 for each season; winter (Feb. 12-16); spring (Apr. 4-6).
			bluegrass	75			13				
			roots (unident. sp.)	25			25				
			plant remains (green	25			13				
			spike rush	13							
			bullrush tubers	25							
			millet seeds	13							
			snails	13							
			no food items				38				
Sedinger & Raveling 1984 (minima)	J	B	Triglochin palustris		68			64	Alaska 1977-79	uplands/lowlands - % dry weight; esophagus contents	Goslings.
			Carex mackenzei (leaves)		18						
			C. ramenskii (leaves		1						
			Puccinella phyganodes (leave		1						
			Carex (seeds)		8						
			Empetrum nigrim (see		1						
			E. nigrim (berries)		1						
			other		2						

***** POPULATION DYNAMICS *****

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Naylor 1953	-	-	BR	-	155		nests/ha				California	NS	Thirty-one nests on 0.5 ha. As cited in Palmer 1962.
Jensen & Nelson 1948	-	-	BR	-	136-163		nests/ha				se Idaho	NS	As cited in Palmer 1962.
HOME RANGE SIZE													
Brakhage 1965 (maxima)	A	M	BR	SP	0.8		ha				Missouri 1961-64	reservoir, marsh	Approximate size of nesting territory defended by "aggressive" males in this resident, managed population.
Eberhardt et al. 1989a (moffitti)	A	F	F	-	983	822 SD	ha	290	2,830	15	sc Washington 1983-4	river	Radiotagged females and broods. Estimate based 75% harmonic mean; values based on three other calculation methods are presented in the paper.
Eberhardt et al. 1989a (moffitti)	A	F	F	-	8.8	4.4 SD	km	2.8	18.1	15	sc Washington 1983-4	river	Length of river used by radiotagged females and broods.
POPULATION DENSITY													
Best et al. 1982	B	B	-	WI	4301		N/ha			6	S Dakota 1979-80	reservoir	N = number of "geese concentrations" found in aerial thermal infrared census of reservoir. Measured N/ha within these concentrations.
Cooper 1978	-	-	-	-			nests/ha	0.02	12.36	14	various locations	NS	Summary of nesting densities found in 14 locations. Both values represent mean densities. As cited in Byrd & Woolington 1983.
Humburg et al. 1985	B	B	1	FA	10.4		N/ha			44.8	Missouri 1955-1984	wildlife refuge	N reflects number of thousands of geese. Data are five year averages for early November of: (1) 1955-59; (2) 1960-64; (3) 1965-69; (4) 1970-74; (5) 1975-79; (6) 1980-84. Total area of refuge is 4,318 ha.
	B	B	2	FA	20.7		N/ha			89.2			
	B	B	3	FA	25.3		N/ha			109.2			
	B	B	4	FA	27.2		N/ha			117.6			
	B	B	5	FA	27.7		N/ha			119.6			
	B	B	6	FA	22.0		N/ha			94.8			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Humburg et al. 1985	B	B	1	WI	3.6		N/ha			15.5	Missouri 1955-84	wildlife refuge	N represents number of thousands of geese. Data are five year averages for early January of: (1) 1955-59; (2) 1960-64; (3) 1965-69; (4) 1970-74; (5) 1975-79; (6) 1980-84. Total area of the refuge is 4,318 ha.
	B	B	2	WI	11.8		N/ha			50.9			
	B	B	3	WI	9.8		N/ha			42.2			
	B	B	4	WI	9.1		N/ha			39.1			
	B	B	5	WI	10.5		N/ha			45.4			
	B	B	6	WI	3.7		N/ha			15.9			
Byrd & Woolington 1983 (leucopareia)	-	-	1	-	0.35		nests/ha			288	Alaska 1975-77	Buldir Island	Nest density in preferred habitat: (1) "most" preferred = beach rye - umbel community; (2) "next most" preferred = beach rye - umbel - fern community. N = ha of each plant community on the island.
	-	-	2	-	0.16		nests/ha			203			
Geis 1956 (moffitti)	-	-	1	-	16.6		nests/ha			5	Montana 1953-54	wooded islands in lake	Density of nests on islands between (1) 0.2-0.8 ha in size; (2) 0.8-2.2 ha; and (3) 8-121 ha. N = number of islands in each size class.
	-	-	2	-	6.8		nests/ha			4			
	-	-	3	-	1.3		nests/ha			4			
McCabe 1979 (moffitti)	-	-	1	-	0.16-.20		nests/ha				OR, WA 1974-75	islands in river	Major nesting islands (1) largest; (2) smallest; (3) in-between sized islands. Nesting on ground and on man-made nesting platforms. Range is values found in 1974 and 1975.
	-	-	2	-	2.2-4.4		nests/ha						
	-	-	3	-	0.16-1.2		nests/ha						
Bromley (pers. comm.) (occidentalis)	-	-	BR	-			nests/ha		0.707		Alaska 1978	coastal wetland	Highest density found. As cited in Cornely et al. 1985.
Trainer 1959 (occidentalis)	-	-	BR	-	0.417		nests/ha				Alaska 1959	coastal wetland	As cited in Cornely et al. 1985.
Smith & Sutton 1953; 1954 (parvipes)	B	B	BR	SU	0.0051	0.0032 SD	N/ha	0.0013	0.0093	7	Yukon, CAN 1948-54	old crow flats	510,230 hectares sampled; N= number of years sampled. As cited in Grieb 1970.
Smith & Sutton 1953; 1954 (parvipes)	B	B	BR	SU	0.00038		N/ha	0.00031	0.00050	4	NW Terr., CAN 1951-54	forest tundra	25,062,900 hectares sampled; N= number of years sampled. As cited in Grieb 1970.
Smith & Sutton 1953; 1954 (parvipes)	B	B	BR	SU	0.00080	0.000086 SD	N/ha	0.00007	0.0019	5	NW Terr., CAN 1948-54	coastal tundra	2,241,645 hectares sampled; N= number of years sampled. As cited in Grieb 1970.
Smith & Sutton 1953; 1954 (parvipes)	B	B	BR	SU	0.0011	0.0018 SD	N/ha	0.00004	0.0046	6	NW Terr., CAN 1948-53	treeless delta	414,400 hectares sampled; N= number of years sampled. As cited in Grieb 1970.

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Smith & Sutton 1953; 1954 (parvipes)	B	B	BR	SU	0.0025	0.0015	SD N/ha	0.001	0.0046	6	NW Terr., CAN 1949-54	closed forest	10,739,430 hectares sampled; N= number of years sampled. As cited in Grieb 1970.
CLUTCH SIZE													
MacInnes 1962; MacInnes et al. 1974 (hutchinsii)	-	-	-	-	4.34					580	NW Terr., CAN	river	As cited in Dunn and MacInnes 1987.
Raveling & Lumsden 1977 (interior)	-	-	-	-	4.57					272	Ontario, CAN	Kinoje Lake	As cited in Dunn and MacInnes 1987.
Byrd & Woolington 1983 (leucopareia)	-	-	-	-	5.6	0.1	SE	2	8	188	Alaska 1974-77	Buldir Island	82% of nests contained 5-7 eggs.
Bellrose 1976 (maxima)	-	-	-	-	5.22					2,982	NS	NS	Summary of many studies.
Bultsma et al. 1979 (maxima)	-	-	-	-	5.27					159	S Dakota 1974-75	wetlands/stock ponds	Only incubated nests counted.
Combs et al. 1984	-	-	-	-	5.6			5.2	5.9	277	se AL, sw GA 1977-82	reservoir	Nesting attempts: (1) initial attempt; (2) renesting attempt. Min and Max are yearly averages. Resident flock of mostly maximas, but also some interior and canandensis.
(maxima)	-	-	1	-	5.9					14			
	-	-	2	-	5.1					14			
Spencer et al. 1951 (minima)	-	-	-	-	4.7					47	Alaska	NS	As cited in Palmer 1976.
Akesson & Raveling 1981 (moffitti)	-	-	-	-	5.5			5	7	11	California 1976-78	captive	
Dow 1943 (moffitti)	-	-	-	-	5.1					355	California	Honey Lake	As cited in Palmer 1976.
Geis 1956	-	-	1	-	5.55			2	10	169	Montana	lake, river	Year: (1) 1953; (2) 1954.
(moffitti)	-	-	2	-	5.15			3	9	189	1953-54		

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Hanson & Eberhardt 1971; Fitzner & Rickard 1983 (moffitti)	-	-	-	-	5.64					3,816	Washington	NS	Hanford Reach. As cited in Dunn and MacInnes 1987.
Hilley 1976 (moffitti)	-	-	-	-	5.20					248	S Dakota	NS	Waubay, SD. As cited in Dunn and MacInnes 1987.
McCabe 1979 (moffitti)	-	-	-	-	5.9					255	WA, OR 1974-75	islands in river	
Sherwood 1966 (moffitti)	-	-	-	-	5.13					442	Michigan	NS	Seney MI. As cited in Dunn and MacInnes 1987.
Steel et al. 1957 (moffitti)	-	-	-	-	5.2			1	9	365	Idaho 1949-51	Gray’s Lake	
Will 1969; Szymczak 1975 (moffitti)	-	-	-	-	4.72					688	Colorado	NS	Larimer County. As cited in Dunn and MacInnes 1987.
Lebeda & Ratti 1983 (occidentalis)	-	-	-	-	4.40					19	Alaska	Admiralty Island	As cited in Dunn and MacInnes 1987.
CLUTCHES/YEAR													
Brakhage 1985 (maxima)	-	-	-	-	1		/year		2		nw Missouri 1983	pond	Canada geese normally attempt 1 brood per year, but may replace clutches lost early in the incubation period. One pair in this study hatched two broods of one gosling each.
DAYS INCUBATION													
Byrd & Woolington 1983 (leucopareia)	-	-	-	-	28		days	27	29	3	Alaska 1974-77	Buldir island	
Brakhage 1965 (maxima)	-	-	-	-	28		days				Missouri 1961-64	reservoir, marshes	Resident population.
Mainguy & Thomas 1985 (maxima)	-	-	-	-	26		days				Ontario, CAN 1980-81	fields, farms	

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Laidley 1939 (minima)	-	-	-	-	25		days				NS	NS	As cited in Palmer 1976.
Mickleson 1973 (minima)	-	-	-	-	26		days	24	30	45	Alaska	Yukon Delta	As cited in Bellrose 1976.
Akesson & Raveling 1981 (moffitti)	-	-	-	-	27		days				California 1976-78	captive	
AGE AT FLEDGING													
Palmer 1976 ("giant")	-	-	-	-	56-63		days				NS	NS	"Giant" in this document refers to the maxima and moffitti subspecies.
MacInnes (pers. comm.) (hutchinsii)	-	-	-	-	52-60		days				NW Terr., CAN	river delta	As cited in Bellrose 1976.
Hanson 1965 (interior)	-	-	-	-	63		days				Ontario, CAN	island in James Bay	As cited in Bellrose 1976.
Lee (pers. comm.) (leucopareia)	-	-	-	-	55		days				NS	captive	Age flight attained; as cited in Byrd & Woolington 1983.
Sherwood 1965 (maxima)	-	-	-	-	71-73		days				Michigan 1963-65	refuge	As cited in Bellrose 1976.
Mickelson 1973 (minima)	-	-	-	-	40-46		days				Alaska	coastal	As cited in Bellrose 1976.
Eberhardt et al. 1989c (moffitti)	-	-	-	-	75-80		days				Washington 1983-84	river	Age when young seen flying.
Moffitt 1931 (moffitti)	-	-	-	-	49-56		days				California	NS	As cited in Bellrose 1976, and Palmer 1976.
N HATCH/ACTIVE NEST													
Geis 1956	-	-	1	-	3.53		hatch/act			173	Montana	lake, river	Number of eggs hatching per active nest: (1) 1953; (2) 1954.
(moffitti)	-	-	2	-	2.22		hatch/act			210	1953-54		

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
N FLEDGE/ACTIVE NEST													
Eberhardt et al. 1989b (moffitti)	-	-	-	-	2.19	2.42 SD	fledge/act	0	7	27	Washington 1983-84	river	Counts of number of goslings of all breeding radiotagged females surviving to fledging.
N HATCH/SUCCESSFUL NEST													
Combs et al. 1984 (maxima)	-	-	-	-	4.0		hatch/suc				se GA, sw AL 1978-82	reservoir	Number hatching in nests hatching at least one egg.
Geis 1956	-	-	1	-	5.14		hatch/suc			145	Montana	lake and river	Number hatching per each nest successfully hatching young: 1953; (2) 1954.
(moffitti)	-	-	2	-	4.64		hatch/suc			115	1953-54		
Steel et al. 1957 (moffitti)	-	-	-	-	4.4		hatch/suc				Idaho 1949-59	Gray’s Lake	Number hatching in nests hatching at least one egg.
N FLEDGE/SUCCESSFUL NEST													
Dey 1966	-	-	-	-	3.9		fledge/suc				Utah	Ogden Bay	Number fledging per pair of adults fledging at least one gosling. As cited in Bellrose 1976.
Hardy & Tacha 1989	-	-	1	-	1.3		fledge/suc				IL, WI 1985-87	lake	Number of young in family groups - counted from October through April on wintering grounds. Parental age: (1) 2.5-4.5 years; (2) > 5 years.
(interior)	-	-	2	-	2.2		fledge/suc						
Byrd & Woolington 1983 (leucopareia)	-	-	-	-	3.99	0.008 SE	fledge/suc	1	7	255	Alaska 1976	Buldir Island	Number fledged per pair fledging at least one young; based on family counts.
Raveling 1981	-	-	1	-	2.3	0.39 SE	fledge/suc			12	Manitoba, CAN	lake	Number raised from hatch to fledge by pairs fledging at least one young. Age: (1) 2 years; (3) 3 & 4 years; (4) 4+ to 18 years.
(maxima)	-	-	2	-	2.9		fledge/suc			27			
	-	-	3	-	3.7	0.22 SE	fledge/suc			76			
Eberhardt et al. 1989b (moffitti)	-	-	-	-	3.93	1.87 SD	fledge/suc	1	7	15	Washington 1983-84	river	Counts of number of goslings of successful radiotagged females surviving to fledging.

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
PERCENT NESTS SUCCESSFUL													
Byrd & Woolington 1983 (leucopareia)	-	-	-	-	91		%/yr	89	93	188	Alaska 1975-76	Buldir Island	Percent hatching at least one egg; island does not have any mammalian predators.
Bultsma et al. 1979 (maxima)	-	-	-	-	57		%/yr			159	w S Dakota 1974-75	stockponds/wetlands	Percent hatching at least one egg.
Combs et al. 1984 (maxima)	-	-	-	-	44		%/yr	27	64	323	se AL, sw GA 1977-82	reservoir	Percent hatching at least one egg; resident flock descended from mostly maxima, but some interior and canandensis.
Geis 1956 (moffitti)	-	-	-	-	61		%/yr	51	73	423	Montana 1953-54	lake, river	Percent hatching at least one egg.
LeBlanc 1987c (moffitti)	-	-	-	-	53		%/yr	49	58	118	Alberta, CAN 1983-84	lake	Percent hatching at least one egg.
AGE AT SEXUAL MATURITY													
MacInnes & Dunn 1988 ("small")	-	B	-	-	2-3		years				NW Terr., CAN 1965-71	river	"Small" subspecies were hutchinsii and parvipes.
Palmer 1962 ("large")	-	B	-	-			years	2			NS	NS	
Moser & Rusch 1989 (interior)	-	F	-	-	4-5		years	2			Manitoba, CAN 1981-84	coastal	Mean age at first nesting; most 2, 3, and 4 year olds did not nest.
Brakhage 1965 (maxima)	-	M	-	-	2-3		years	1			Missouri 1961-64	reservoir, marsh	Resident population.
	-	F	-	-	2-3		years	2					
ANNUAL MORTALITY													
Samuel et al. 1990	A	B	1	-	21.4		%/yr				Wisconsin 1974-80	wildlife refuge	Band location: (1) leg banded; (2) neck banded. Neck vs. leg banding results were significantly different for the juvenile data, but not significantly different for the adult data. Difference thought to be due primarily to higher reporting percentage of neck bands. Subspecies not specified.
	A	B	2	-	23.1		%/yr						
	J	B	1	-	31.5		%/yr						
	J	B	2	-	41.4		%/yr						

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Chapman et al. 1969 (fulva)	A	B	-	-	33.5		%/yr				Alaska 1956-65	NS	Banded as adults; as cited in Bellrose 1976.
Hanson & Smith 1950 (interior)	J	B	-	-	65.4		%/yr				Illinois 1940-47	lake	As cited in Bellrose 1976.
	B	B	-	-	52.0		%/yr						
Vaught & Kirsch 1966 (interior)	J	M	-	-	62.6		%/yr				Missouri 1950-60	NS	Banded as immatures; as cited in Bellrose 1976.
	J	F	-	-	53.1		%/yr						
	A	M	-	-	35.4		%/yr						
	A	F	-	-	24.4		%/yr						
	B	M	-	-	49.5		%/yr						
	B	F	-	-	35.4		%/yr						
Brakhage et al. 1987 (maxima)	J	-	1	-	43		%/yr			229	Missourri 1983	lake	(1) Gosling mortality.
Brakhage 1965 (maxima)	J	B	-	-	32		% to fledge	20	36		Missouri 1961-64	reservoir, marsh	Gosling mortality from hatching to fledging; resident population.
Bultsma et al. 1979 (maxima)	J	B	-	-	16		% to fledge			159	S Dakota 1974-75	wetlands/stock ponds	Gosling mortality from hatching to fledging; N reflects number of nests in the study.
Cummings 1973 (maxima)	J	B	-	-	37.0		%/yr				Ohio 1968	NS	Banding study; as cited in Bellrose 1976.
	A	B	-	-	22.9		%/yr						
	B	B	-	-	28.4		%/yr						
Gulden & Johnson 1968 (maxima)	A	B	-	-	45.8		%/yr				Minnesota 1961-66	NS	Banded as adults; as cited in Bellrose 1976.
Sherwood 1965 (maxima)	-	-	-	-	35		%/yr				Michigan 1962-64	NS	As cited in Bellrose 1976.
West 1982 (maxima)	J	B	-	-	74		% to fledge				Missouri 1977-79	reservoir, marsh	Gosling mortality from hatching to fledging; as cited in Brakhage et al. 1987.
Nelson & Hansen 1959 (minima)	J	B	-	-	46.0		%/yr				Alaska 1949-54		Banded as immatures; as cited in Bellrose 1976.
	A	B	-	-	35.9		%/yr						
Eberhardt et al. 1989b (moffitti)	J	B	-	-	50.9	0.4 SE	% to fledge			152	Washington 1983-84	river	Gosling mortality from hatching to fledging.

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Geis 1956 (moffitti)	J	B	-	-	19		% to fledge			1,390	Montana 1953-54	river, lake	Gosling mortality form hatching to fledging. N = number that hatched.
Hanson & Eberhardt 1971 (moffitti)	A	B	-	-	30		%/yr				Washington 1950-60	NS	Banded as immatures; as cited in Bellrose 1976.
	J	B	-	-	40		%/yr						
Martin 1964 (moffitti)	J	M	-	-	63		%/yr				Utah 1952-58	Ogden Bay Refuge	As cited in Bellrose 1976.
	J	F	-	-	65		%/yr						
	A	M	-	-	46		%/yr						
	A	F	-	-	50		%/yr						
Martin 1964 (moffitti)	J	B	-	-	53		%/yr				Utah 1946-58	Bear River	Banded as immatures; as cited in Bellrose 1976.
	J	M	-	-	47		%/yr						
	J	F	-	-	47		%/yr						
	A	B	-	-	38		%/yr						
	A	M	-	-	40		%/yr						
	A	F	-	-	36		%/yr						
Rienecker 1987 (moffitti)	A	B	-	-	28	0.8 SD	%/yr				ne CA, w NV 1949-1979	lakes	Based on band recoveries from approximately 33,000 geese banded on nesting and molting areas; includes harvest and natural mortality.
	J	B	-	-	49	3.7 SD	%/yr						
Chapman et al. 1969 (occidentalis)	A	M	-	-	38.8		%/yr				Alaska 1952-59	NS	Banded as immatures; as cited in Bellrose 1976.
	J	M	-	-	58.8		%/yr						
	A	F	-	-	32.1		%/yr						
	J	F	-	-	53.5		%/yr						
Grieb 1970 (parvipes)	B	B	-	-	23.8		%/yr			1,540	Texas 1955-59	shortgrass prairie	Calculated using composite dynamic & relative recovery rate methods (Geis & Taber 1963).
Grieb 1970 (parvipes)	J	B	-	-	28.8		%/yr			4,052	Banded in CO 1951-64	shortgrass prairie	Calculated using composite dynamic recovery rate method (Geis & Taber 1963). N= number of geese banded.
	A	B	-	-	27.2		%/yr			3,168			
	B	M	-	-	41.0		%/yr			1,825			
	B	F	-	-	37.1		%/yr			1,857			
	B	B	-	-	28.0		%/yr			7,220			
Timm 1974 (taverneri)	J	B	-	-	45.6		%/yr				Alaska 1948-58	NS	Mortality in first year after banding; as cited in Bellrose 1976.
	A	B	-	-	24.0		%/yr						

***** SEASONAL ACTIVITIES *****

Reference	Begin	Peak	End	Location	Habitat	Notes
MATING/LAYING						
Bellrose 1976	earl Mar			California		Summary of several studies (i.e., Dow 1943; Naylor 1953; Miller & Collins 1953; Rienecker & Anderson 1960)
Collias & Jahn 1959	Apr 4			Wisconsin	marsh	As cited in Bellrose 1976.
Byrd & Woolington 1983 (leucopareia)	late May	late May	earl Jun	Alaska 1974-77	Buldir Island	
Brakhage 1965 (maxima)	mid Mar			Missouri 1961-64	reservoir, marsh	Resident population.
Combs et al. 1984 (maxima)	late Feb	Mar-Apr	mid May	se GA, sw AL 1972-82	reservoir	Resident poulation descended from primarily maxima but also some interior and canandensis.
Mainguy & Thomas 1985 (maxima)	earl Apr		mid Apr	Ontario, CAN 1981-82	farms, fields	
Mickleson 1973 (minima)	late May			Alaska	Yukon Delta	As cited in Bellrose 1976.
Akesson & Raveling 1981 (moffitti)		mid/late Mar		California 1976-78	captive	
Geis 1956 (moffitti)	mid Mar	late Mar-Apr	May	w Montana 1953-54	lake in valley	About 3,000 ft elevation; at 6,500 feet was about two weeks later.
McCabe 1979 (moffitti)	earl Mar	late Mar		OR, WA 1974-75	islands in river	
Steel et al. 1957 (moffitti)	earl Apr	mid Apr	earl May	Idaho 1959-51	Gray’s Lake	
Trainer 1959 (occidentalis)	mid May			Alaska	coastal wetlands	As cited in Bellrose 1976.

Reference	Begin	Peak	End	Location	Habitat	Notes
HATCHING						
Byrd & Woolington 1983 (leucopareia)		earl Jul		Alaska 1974-77	Buldir Island	
Combs et al. 1984 (maxima)	Mar	Apr - May	earl Jun	se GA, sw AL 1977-82	reservoir	Resident flock of primarily maxima, with some interior and canadensis also.
Sedinger & Raveling 1986 (minima)	mid Jun	mid-late Jun	mid Jul	Alaska 1977-79	river- up & lowlands	Hatching was highly synchronous each year.
Geis 1956 (moffitti)	mid Apr	late Apr-May	late May	w Montana 1953-54	lake in valley	About 3,000 ft elevation; at 6,500 feet was about two weeks later.
Steel et al. 1957 (moffitti)	earl May	mid May	late Jun	Idaho 1959-51	Gray’s Lake	
FALL/BASIC MOLT						
Williams & Kendeigh 1982 (interior)	late Jun		late Oct	s Illinois	captive outside	Wing molt began in late June, body molt began in August when flight feathers were 70-80% regrown.
Byrd & Woolington 1983 (leucopareia)	mid Jul	mid Aug	late Aug	Alaska 1974-77	Buldir Island	Wing molt.
Mainguy & Thomas 1985 (maxima)		Jun 25		Ontario, CAN 1981-82	fields, farms	
Steel et al. 1957 (moffitti)	mid Jun			Idaho 1959-51	Gray’s Lake	Wing molt.
FALL MIGRATION						
Bell & Klimstra 1970 (interior)	mid Sep	Nov		arrive S Illinois	refuges	Population often continues farther south in late Dec-early Jan when food becomes scarce.
Byrd & Woolington 1983 (leucopareia)		Sep		Alaska 1974-77	island	

Reference	Begin	Peak	End	Location	Habitat	Notes
Raveling 1978b (maxima)	Sep 20		Nov 20	Manitoba, CAN 1968-75	lake	Migrating south from Manitoba.
Grieb 1970 (parvipes)	Oct	earl Nov	mid Dec	arriving CO, TX	lakes in refuges	Coming from Yukon and North West Territories, Canada.
SPRING MIGRATION						
Bell & Klimstra 1970 (interior)	Feb	earl Mar		leave S Illinois	refuges	
Prevett et al. 1985 (interior)	mid Apr		earl May	Ontario, CAN 1976-80	bay	Migrating through the James Bay area.
Byrd & Woolington 1983 (leucopareia)	earl May	mid May		arrive Alaska 1974-7	Buldir Island	
Raveling 1978b (maxima)	late Mar	earl Apr		leave Minnesota	lakes	

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
BODY WEIGHT													
Bellrose & Hawkins 1947	A	M	-	FA	1,240		g			631	Illinois	NS	As cited in Palmer 1976.
	J	M	-	FA	1,170		g			730			
	A	F	-	FA	1,080		g			402			
	J	F	-	FA	1,030		g			671			
Bellrose 1976	A	M	-	-	1,247		g			1,809	NS	NS	
	A	F	-	-	1,107		g			1,417			
Delnicki & Reinecke 1986	A	M	-	WI	1,246	108 SD	g			1,308	w Mississippi 1979-83	NS	Alluvial Valley.
	A	F	-	WI	1,095	106 SD	g			453			
Delnicki & Reinecke 1986	J	M	-	WI	1,181		g			169	w Mississippi 1979-83	NS	Alluvial Valley.
	J	F	-	WI	1,040		g			188			
Heitmeyer 1988a	A	F	-	FA	1,010	24 SE	g			11	se Missouri 1981-83	Mingo Basin	The fall middle prealternate molt.
Heitmeyer 1988a	A	F	-	WI	1,118	21 SE	g			44	se Missouri 1981-83	Mingo Basin	Females initiating the prebasic molt.
Heitmeyer 1988a	A	F	-	WI	983	20 SE	g			21	se Missouri 1981-83	Mingo Basin	Females in midwinter, alternate plumage, unpaired.
Heitmeyer 1988a	A	F	-	WI	1,280	13 SE	g			10	se Missouri 1981-83	Mingo Basin	Females in basic plumage; prespring migration departure.
Krapu & Doty 1979	A	F	1	SP	1,197	104.9 SD	g			41	N Dakota 1974-76	prairie potholes	All are nesting females. Age Y = yearlings. Month: (1) April; (2) May; (3) June.
	Y	F	1	SP	1,137	106.9 SD	g			21			
	A	F	2	SP	1,079	104.5 SD	g			60			
	Y	F	2	SP	1,028	96.5 SD	g			20			
	A	F	3	SU	1,012	134.1 SD	g			4			
	Y	F	3	SU	889	13.6 SD	g			3			
Lokemoen et al. 1990a	A	M	-	SP	1,206		g		1277	660	c N Dakota 1976-81	uplands, wetlands	Maximum value represents mean of birds weighed during March 21-March 31; following this period males lost approximately 10% of body weight until about mid May when they began gaining weight again.
Nelson & Martin 1953	A	M	-	-	1,225		g		1,814	3963	US	NS	Data from US FWS records (from banders, game bag investigations).
	A	F	-	-	1,043		g		1,633	3169			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Poole 1938	A	F	-	-	1,234		g			2	NS	NS	
Whyte & Bolen 1984	A	M	-	WI	1,237	118 SD	g			87	Texas 1980-82	s high plains	Late winter (January 8 to February 9).
	A	F	-	WI	1,088	105 SD	g			42			
Whyte & Bolen 1984	J	M	-	FA	1,214	121 SD	g			18	Texas 1980-82	s high plains	Late winter (January 8 to February 9).
	J	F	-	FA	996	145 SD	g			20			
BODY FAT													
Heitmeyer 1988a	A	F	1	-	>200		g				se Missouri 1981-83	wetlands	(1) Females beginning prebasic molt.
Krapu & Doty 1979	A	F	1	-	105.9	34.3 SD	g			19	N Dakota	prairie potholes	All are nesting females. Age Y = yearling. Month: (1) April; (2) May; (3) June.
	Y	F	1	-	81.8	36.6 SD	g			8	1974-76		
	A	F	2	-	49.4	29.8 SD	g			19			
	Y	F	2	-	39.5	16.3 SD	g			5			
	A	F	3	-	22.2	21.9 SD	g			4			
	Y	F	3	-	9.6	8.3 SD	g			3			
Whyte & Bolen 1984	A	M	NB	WI	174	66 SD	g			87	Texas 1980-82	s high plains	Late winter (January 8 to February 9). Percent fat is of body weight: males = 14%; females = 15%.
	A	F	NB	WI	171	56 SD	g			42			
Whyte & Bolen 1984	J	M	NB	WI	171	67 SD	g			18	Texas 1980-82	s high plains	Late winter (January 8 to February 9). Percent fat is of total body weight: males = 14%, females = 13%.
	J	F	NB	WI	128	72 SD	g			20			
EGG WEIGHT													
Eldridge & Krapu 1988	-	-	-	-	52.2		g	32.2	66.7	613	N Dakota	plains	
Eldridge & Krapu 1988	-	-	-	-	53.7		g	39.7	68.8	484	N Dakota	captivity	Some of the variation in egg weight induced by feeding of various diets.
Lokemoen et al. 1990b	-	-	1	-	49.3	3.5 SD	g			27	c N Dakota 1976-81	uplands, wetlands	(1) Fresh egg; (2) pipped egg.
	-	-	2	-	45.5	3.9 SD	g			302			
HATCHING WEIGHT													
Lokemoen et al. 1990b	-	-	-	-	32.4	2.4 SD	g			36	c N Dakota 1976-81	uplands, wetlands	One-day-old young: 42% were dry and 58% were damp at time of weighing.

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
DUCKLING WEIGHT													
Lokemoen et al. 1990b	-	B	1	-	32.4	2.4 SD	g - 3.5 d			36	c N Dakota 1976-81	wetlands, grasslands and croplands	Weights for age groups depicted under units column: (1) 3.5 days old, both males and females, (2) 9.5 days old, females only, and so on. Flying by 56 days of age.
	-	F	2	-	115.3	37.3 SD	g - 9.5 d			6			
	-	F	3	-	265.0	91.9 SD	g - 15.5 d			2			
	-	F	4	-	288.9	60.5 SD	g - 22.0 d			14			
	-	F	5	-	401.2	92.2 SD	g - 30.5 d			20			
	-	F	6	-	575.0	152.9 SD	g - 40.5 d			22			
	-	F	7	-	774.3	124.9 SD	g - 50.5 d			38			
	-	F	8	-	740.0	114.9 SD	g - 56.0 d			5			
Lokemoen et al. 1990b	-	B	1	-	32.4	2.4 SD	g - 3.5 d			36	c N Dakota 1976-81	wetlands, grasslands and croplands	Weights for age groups depicted under units column: (1) 3.5 days old, both males and females, (2) 9.5 days old, males only, and so on. Flying by 56 days of age.
	-	M	2	-	92.2	11.5 SD	g - 9.5 d			4			
	-	M	3	-	215.0	5.0 SD	g - 15.5 d			3			
	-	M	4	-	343.2	75.3 SD	g - 22.0 d			11			
	-	M	5	-	460.3	93.4 SD	g - 30.5 d			30			
	-	M	6	-	648.4	128.4 SD	g - 40.5 d			19			
	-	M	7	-	863.9	102.1 SD	g - 50.5 d			31			
	-	M	8	-	817.1	91.4 SD	g - 56.0 d			7			
FLEDGING WEIGHT													
Lokemoen et al. 1990b	J	M	-	-	817.1	91.4 SD	g			7	c N Dakota	uplands, wetlands	Average age = 56 days. Author suggests that weight loss may be associated with onset of flight.
	J	F	-	-	740.0	114.9 SD	g			5			
LEAN (DRY) BODY WEIGHT													
Whyte & Bolen 1984	A	M	NB	WI	260		g				Texas	s high plains	
	A	F	NB	WI	220		g						
Whyte & Bolen 1984	A	M	NB	FA	263.3		g	260	270	22	Texas	s high plains	Average of three intervals between Nov 2 and Dec 14. Min = average value for Nov 2 to 15. Max = average value for Dec 1 to 14.
	A	F	NB	FA	245		g	240	250	14			
METABOLIC RATE (KCAL BASIS)													
McEwan & Koelink 1973	A	B	1	-	104		kcal/kg-d				Canada	lab	Resting - estimated from figure. Temperature (degrees C): (1) 0; (2) 10; (3) 15-25. Measured O2 consumption and CO2 production to estimate kcal values; 43 observations on 9 birds.
	A	B	2	-	85		kcal/kg-d						
	A	B	3	-	80		kcal/kg-d						

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Whyte & Bolen 1984	A	M	1	WI	220		kcal/kg-d				Texas 1980-82	NS	Estimate of daily existence energy requirements for wintering ducks at (1) 0 C; (2) -10 C; (3) -20 C. Data converted from kcal/day to kcal/kg-day using mean weight of females (1,058 g) and males (1,233 g).
	A	F	1	WI	280		kcal/kg-d						
	A	M	2	WI	290		kcal/kg-d						
	A	F	2	WI	365		kcal/kg-d						
	A	M	3	WI	358		kcal/kg-d						
	A	F	3	WI	440		kcal/kg-d						

***** DIET *****

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Delnicki & Reinecke 1986	A	B	soybeans				28.8	311	Mississippi 1979-82	NS - % dry weight; esophagus contents	
			rice				19.8				
			non-agricultural								
			jungle-rice				4.3				
			broadleaf grass				1.8				
			fall panicum				0.5				
			rice cutgrass				26.7				
			flat sedge				1.2				
			dotted smartweed				3.8				
			animals								
			snails				1.5				
Dillon 1959	A	B	rice				24.3	106	Louisiana 1954-58	coast marsh, coast prairie - % volume; gullet contents	Collected in November, December, and January.
			jungle rice				20.7				
			brownseed paspalum				19.2				
			barnyardgrass				8.0				
			red rice				8.0				
			knot grass				6.5				
			signal grass				2.5				
			coast cockspur				1.9				
			Jamaica sawgrass				1.3				
			snails				1.0				
			flatsedge				1.0				
			insects				0.7				
			fall panic				0.6				
			unidentified								
			vegetation				0.4				
			birdeye				0.3				
			swamp smartweed				0.2				
			squarestem								
			spikesedge				0.2				
			smartweed				TR				
			schreber watershield				TR				

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Dillon 1959	A	B	rice				20.4	125	Louisiana 1954-58	coast marsh, coast prairie - % volume; gizzard contents	Collected in November, December, and January.
			unidentified vegetation				18.0				
			Jamaica sawgrass				13.6				
			junglerice				11.0				
			squarestem spikesedge				8.5				
			brownseed paspalum				8.1				
			barnyard grass				3.3				
			schreber watershield				3.2				
			stonewort				2.4				
			coast cockspur				1.8				
			knotgrass				1.7				
			red rice				1.6				
			flatsedge				1.4				
			smartweed				0.7				
			insects				0.5				
			signalgrass				0.3				
			birdeye				TR				
			California bulrush				TR				
Jorde et al. 1983			(plant total)				(96.8)	68	sc Nebraska 1979-80	river, agricultural area - % dry weight, esophagus contents	Data collected from 11 December to 13 March.
			corn				51.7				
			Polygonum spp. (seeds)				9.6				
			Echinochloa muricata (seeds)				3.8				
			Milo				2.6				
			Lemma minor (vegetation)				12.6				
			other plant				16.5				
			(animal total)				(3.2)				
			mollusca				2.9				
			insecta				0.3				
Martin et al. 1951	A	B	pondweed seed/veg.				10-25	87	OR, WA, CA	NS - rough approximation of % diet; stomach contents	Ducks shot in winter = 58, in fall = 29. Items in the 0.5 - 2% category not included here.
			bulrush				10-25				
			barley				5-10				
			spikerush				2-5				
			watermilfoil				2-5				
			smartweed				2-5				
			oats				2-5				
			marestail seed/veg.				2-5				
			cowlily				2-5				
			burreed				2-5				
			waterhemlock				2-5				
			arrowgrass				2-5				

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Martin et al. 1951	A	B	wild millet				5-10	266	se United States	NS - rough approximation of % diet; stomach contents	Items in the 0.5 - 2% category not included here.
			smartweed				5-10				
			bulrush				5-10				
			duckweed (veg.)				5-10				
			spikerush				5-10				
			pondweed (seed/veg.)				5-10				
			rice				5-10				
			naiad (seed/veg.)				2-5				
			widgeongrass				2-5				
			oak				2-5				
			arrowhead (tuber)				2-5				
			coontail (seed/veg.)				2-5				
			buttonbrush				2-5				
			chufa (tuber/seed)				2-5				
			bald cypress				2-5				
McAtee 1918	A	B	grasses		13.4			1578	US, CAN	NS - percent (type NS) stomach contents	Data predominantly from Louisiana, but also from 22 other states and 2 Canadian provinces. Season not specified. As cited in Palmer 1976.
			sedges		21.6						
			smartweed seeds		9.9						
			pondweeds		8.2						
			duckweeds		12.0						
			wild celery		4.3						
			tree seeds		8.2						
			misc. seeds		8.9						
			insects		2.7						
			snails		5.7						
Perret 1962	A	M	invertebrates (primarily Insecta)	46				50	Manitoba, CAN	NS - % by volume	As cited in Swanson & Meyer 1973. Evaluated in spring and summer.
			other	54							
Perret 1962	A	F	invertebrates (primarily Insecta)	64				46	Manitoba, CAN	NS - % by volume	As cited in Swanson & Meyer 1973. Evaluated in spring and summer.
			other	36							
Perret 1962	J	B	invertebrates (primarily Insecta)	99				19	Manitoba, CAN	NS - % by volume	As cited in Swanson & Meyer 1973. Evaluated in spring and summer.
			other	1							
Stoudt 1944	B	B	seeds					306	Minnesota 1940	NS - % diet; measure NS	As cited in Palmer 1976.
			Zizamia aquatica			35.5					
			Potamogeton strictifolius			22.8					
			Sparganium chlorocarpum			11.1					

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Swanson, unpublished data	A	F	Mollusca		(14)			15	sc N Dakota 1969-76	prairie potholes - % wet volume; esophagus contents	All birds were laying females. As cited in Swanson et al. 1979. TR = trace.
			Gastropoda								
			Lymnaea spp.		14						
			Insecta		(14)						
			Odenata		5						
			Coleoptera		TR						
			Lepidoptera		7						
			Diptera		2						
			Crustacea		(16)						
			Anostraca		TR						
			Conchostraca		9						
			Ostracoda		TR						
			Cladocera		6						
			Amphipoda		1						
			Annelida		(26)						
			Oligochaeta (terrestrial)		24						
			Hirudinea		2						
			Vegetation		3						
			Fruits		(27)						
			Echinochloa crusgalli		15						
			misc.		12						
Swanson et al. 1985	A	M	seeds			86		63	North Dakota 1974-76	prairie potholes - % wet weight, esophagus contents	Estimated from Figure 1. Birds shot by hunters.
			vegetation			12					
			animal			2					
Swanson et al. 1985	A	F	seeds			100		20	North Dakota 1974-76	prairie potholes - % wet weight, esophagus contents	Estimated from Figure 1. Birds shot by hunters.
Swanson et al. 1985	A	F	MONTH	APRIL	MAY	JUNE		37	sc N Dakota 1974-80	prairie potholes - % wet volume; esophagus contents	Diet of laying females over the course of the breeding season.
			(total animal)	(67.8)	(66.8)	(89.4)					
			gastropods	TR	24.9	16.5					
			insects	13.1	25.6	48.1					
			crustaceans	7.9	15.1	13.9					
			annelids	38.3	0.2	10.9					
			misc. animal	8.5	1.0	-					
			(total plant)	(32.2)	(33.2)	(10.6)					
			seeds	28.7	28.7	10.6					
			tubers	2.4	4.3	-					
			stems	1.1	0.2	-					

Reference	Age	Sex	Food type	Spring	Summer	Fall	Winter	N	Location	Habitat - Measure	Notes
Swanson et al. 1985	A	M	(total animal)	(37.6)				39	sc N Dakota 1974-80	prairie potholes - % wet volume, esophagus contents	Season is breeding season.
			gastropods	6.3							
			insects	16.8							
			crustaceans	11.3							
			(total plant)	(62.4)							
			seeds	56.4							
			vegetation	6.0							
			roots and tubers	4.1							
Swanson et al. 1985	A	F	(total animal)	(37.0)				41	sc N Dakota 1974-80	prairie potholes - % wet volume, esophagus contents	Non-laying females during the breeding season.
			gastropods	4.5							
			insects	22.6							
			crustaceans	7.5							
			(total plant)	(63.0)							
			seeds	58.5							
			vegetation	4.5							
			roots and tubers	3.9							
Swanson et al. 1985	A	F	(total animal)	(71.9)				37	sc N Dakota 1974-80	prairie potholes - % wet volume, esophagus contents	Laying females during the breeding season. Consumption of invertebrates by laying females was significantly different from that of non-laying females and males.
			gastropods	16.4							
			insects	27.1							
			crustaceans	12.9							
			oligochaetes	11.8							
			(total plant)	(28.1)							
			seeds	24.8							
			vegetation	3.3							
			roots and tubers	2.8							

***** POPULATION DYNAMICS *****

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
HOME RANGE SIZE													
Dwyer et al. 1979	A	F	1	-	467.8	158.6 SD	ha	306.6	718.9	6	N Dakota 1973-75	prairie potholes, semi-arid	(1) Total home range; (2) laying home range.
	A	F	2	-	110.9	75.6 SD	ha	38.1	239.8	6			
Dzubin 1955	-	-	-	-	> 283		ha				Manitoba, CAN	NS	As cited in Palmer 1976 and Bellrose 1976.
Gilmer et al. 1975	A	F	-	SP	210		ha	66		12	Minnesota 1968-72	upland forest	Average minimum home range size. N = prenesting period; L = laying period.
	A	M	-	SP	240		ha			12			
	A	F	N	SP	135		ha			8			
	A	F	L	SP	70		ha			8			
	A	B	-	SP			ha		760				
Kirby et al. 1985	A	F	-	SP	540		ha	40	1440	8	Minnesota 1971-72	wetlands, river	
	A	M	-	SP	620		ha	70	1140	5			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
POPULATION DENSITY													
Bellrose 1976	-	-	BR	-	0.0305		N/ha				n Montana	NS	
Duebbert & Kantrud 1974	A	B	1	SP	0.0270	0.0062 SE	pairs/ha			15	n c S Dakota 1971	prairie potholes	Breeding pair density: (1) in area without predator reduction; (2) in area where egg predators were reduced.
	A	B	2	SP	0.0502	0.0073 SE	pairs/ha			20			
Duebbert & Lokemoen 1976	A	B	1	SP	0.0265		pair/ha			43	S Dakota 1971-73	prairie potholes, fields	Density of breeding pairs: (1) 1971; (2) 1972; (3) 1973. Ducks seemed to show a preference for idle fields, rather than farmed or grazed ones.
	A	B	2	SP	0.0488		pair/ha			79			
	A	B	3	SP	0.0377		pair/ha			276			
Dzubin 1955	-	B	-	SU	1.5		pairs/ha				Alberta, CAN	NS	As cited in Palmer 1976.
Johnson et al. 1988	-	-	1	SU	0.0046		nests/ha				ND, SD, MT 1983	prairie potholes	Type of area: (1) grassland; (2) hayland; (3) planted cover; (4) cropland; (5) wetland.
	-	-	2	SU	0.0069		nests/ha						
	-	-	3	SU	0.033		nests/ha						
	-	-	4	SU	0.0014		nests/ha						
	-	-	5	SU	0.014		nests/ha						
Kantrud & Stewart 1977	A	B	1	SU	0.667		pairs/ha				N Dakota 1965, 67-69	prairie potholes	Density of breeding ducks on different wetland types containing ponded water (as defined in Stewart and Kantrud 1971): (1) temporary; (2) seasonal; (3) semi-permanent; (4) permanent; (5) fen; (6) undifferentiated tillage.
	A	B	2	SU	0.449		pairs/ha						
	A	B	3	SU	0.286		pairs/ha						
	A	B	4	SU	0.043		pairs/ha						
	A	B	5	SU	0.273		pairs/ha						
	A	B	6	SU	0.295		pairs/ha						
Lokemoen et al. 1990a	A	B	1	SP	0.036		pairs/ha	0.006	0.076	6	c N Dakota 1976-81	prairie potholes	N = number of years averaged to get mean. Density of breeding pairs: (1) Koenig study area; (2) Woodworth study area. Over the years of the study the number of wet basins in each area was highly variable.
	A	B	2	SP	0.047		pairs/ha	0.031	0.087	6			
Pospahala et al. 1974	A	B	-	SU	0.012		N/ha				s Canada 1955-73	prairie potholes	18 year mean based on aerial surveys in May and July. Location is prairie parkland area in southern portions of Alberta, Saskatchewan, and Manitoba.

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
CLUTCH SIZE													
Bellrose 1976	-	-	-	-	9			1	18	5170	NS	NS	
Coulter & Miller 1968	-	-	-	-	9.6					>100	Maine, Vermont		As cited in Bellrose 1976.
Doty 1975	-	-	1	-	10-11		1st clutch			8	w N Dakota		
	-	-	2	-	3-6		2nd clutch			5	1968-71		
Duebbert & Lokemoen 1976	-	-	-	-	8.6			8.2	8.8	100	S Dakota 1971-73	undisturbed fields	Min and max are yearly means.
Fuller 1953	-	-	-	-	9.6						Utah	Ogden Bay	As cited in Bellrose 1976.
Krapu & Doty 1979	Y	F	-	-	9.3	1.7 SE				7	N Dakota	prairie potholes	Initial completed clutches. Y = yearling female.
	A	F	-	-	10.3	1.1 SE				46	1968-76		
Lokemoen et al. 1990b	-	-	1	-	8.96	1.38 SE				78	c N Dakota	prairie potholes	(1) After-second-year females; (2) second-year females.
	-	-	2	-	8.49	1.23 SE				57	1976-81		
Palmer 1976	-	-	-	-	8.9					494	California	NS	Summarizing several other studies.
Palmer 1976	-	-	-	-	7.1					257	Montana	NS	Summarizing several other studies.
Palmer 1976	-	-	-	-	8.6					185	Utah	NS	Summarizing several other studies.
NUMBER OF CLUTCHES/YEAR													
Swanson unpub. Swanson et al. 1985	-	-	-	-					up to 4.5		N Dakota	experimental ponds	Nests purposely destroyed to stimulate renesting.
Bellrose 1976	-	-	-	-	1						North America	NS	Many females will renest if they lose their clutch.
DAYS INCUBATION													
Bent 1923	-	-	-	-	26		days	23	29		NS	NS	As cited in Palmer 1976.
Girard 1941	-	-	-	-	28	2 SD	days				NS	NS	As cited in Palmer 1976.
Klett & Johnson 1982	-	-	-	-	25		days				N Dakota	wetlands	

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
AGE AT FLEDGING													
Bellrose 1976	J	B	-	-	52-60		days				NS	NS	
Gollop & Marshall 1954	-	-	-	-	52-60		days				NS	NS	As cited in Palmer 1976.
N FLEDGE/SUCCESSFUL NEST													
Bellrose 1976	-	-	-	-	8.4		N/suc nest				United States	NS	Summary of many sources.
Cowardin & Johnson 1979	-	-	-	-	4.9		N/suc nest				NS	NS	Average fledged brood size. As cited in Johnson et al. 1987.
PERCENT NESTS SUCCESSFUL													
Duebbert & Lokemoen 1976	-	-	1	-	54		% hatched			33	S Dakota 1971-73	prairie potholes, undisturbed fields	Percent nests hatched: (1) 1971; (2) 1972; (3) 1973. Main egg predators found to include red fox, raccoon, badger, skunk, and avian species. Author suggests success is high in part because sample does not include actively farmed areas where more nests are destroyed.
	-	-	2	-	61		% hatched			61			
	-	-	3	-	51		% hatched			47			
Johnson et al. 1988	-	-	-	-	7		% hatched			99	ND, SD, MT 1983	various unmanaged areas in prairie pothole regions (e.g., grassland, hayland, right-of-way, wetland)	Mayfield measure of nesting success. Found predation to be the biggest cause of losses. Success falls below 15 % level thought to be needed to maintain a stable population.
Klett et al. 1988	-	-	1	-	9		% hatched			51	e S Dakota	prairie potholes	Years: (1) 1966-74; (2) 1980-84. Population not self-sustaining in this area.
	-	-	2	-	10		% hatched			79			
Klett et al. 1988	-	-	-	-	19		% hatched			487	c S Dakota 1966-74	prairie potholes	
Klett et al. 1988	-	-	1	-	8		% hatched			210	c N Dakota	prairie potholes	(1) 1966-74; (2) 1975-79; (3) 1980-84.
	-	-	2	-	11		% hatched			1,036			
	-	-	3	-	10		% hatched			929			
Klett et al. 1988	-	-	-	-	5		% hatched			314	w MN, e N Dakota	prairie potholes	Data from two study sites combined: w Minnesota 1980-84 and e North Dakota 1966-84.

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Lokemoen et al. 1990a	-	-	-	-	11		% hatched		27	53	N Dakota 1976-81	mixed	Calculated using the Mayfield 40% method. Habitats consisted of cropland, grazed mixed-grass prairie, hayland, wetlands, and miscellaneous.
Lokemoen et al. 1988	-	-	1	-	8		% hatched			12	c N Dakota 1985-86	NS	(1) untreated control areas; (2) areas with predator barriers.
	-	-	2	-	60		% hatched			12			
Simpson 1988	-	-	1	-	15.4		% success			14	ne S Dakota 1985-86	game production areas	Mayfield measure of nesting success in (1) 1985 and (2) 1986 in game production areas throughout ne S Dakota.
	-	-	2	-	31.7		% success			39			
Simpson 1988	-	-	1	-	43.2		% success			63	ne S Dakota 1985-86	island in large lake	Mayfield measure of nesting success in (1) 1985 on Lake Albert Island.
ANNUAL MORTALITY													
Bellrose 1976	A	M	-	-	27.2		%/yr				Eastern c flyway	NS	Summary of other studies.
	A	F	-	-	38.2		%/yr						
Brownie et al. 1978	A	F	-	-	37.2		%/yr			6 yr	Minnesota	NS	As cited in Kirby and Cowardin 1986.
	J	F	-	-	54.5		%/yr			6 yr			
Chu & Hestbeck 1989	A	M	-	FA	40.1	3.1 SE	%/yr	22	51	5376	w m Atlantic 1971-85	NS	H1 and H2 models of Brownie et al. 1985.
	J	M	-	FA	41.1	7.2 SE	%/yr	31	59	12391			
	A	F	-	FA	49.9	3.3 SE	%/yr	20	72	5429			
	J	F	-	FA	48.8	6.0 SE	%/yr	15	68	11137			
Chu & Hestbeck 1989	A	M	-	FA	36.3	1.8 SE	%/yr	12	52	5528	MI, n OH, IN 1971-85	NS	H1 and H2 models of Brownie et al. 1985.
	J	M	-	FA	46.6	3.0 SE	%/yr	21	60	12821			
	A	F	-	FA	45.6	1.7 SE	%/yr	16	69	7392			
	J	F	-	FA	50.7	3.1 SE	%/yr	38	74	12047			
Chu & Hestbeck 1989	A	M	-	FA	38.5	1.3 SE	%/yr	19	53	9252	WI, n IL 1972-85	NS	H1 and H2 models of Brownie et al. 1985.
	J	M	-	FA	55.9	1.8 SE	%/yr	43	73	20274			
	A	F	-	FA	47.7	1.4 SE	%/yr	23	59	12912			
	J	F	-	FA	57.3	2.0 SE	%/yr	41	68	22371			
Chu & Hestbeck 1989	A	M	-	FA	32.9	1.6 SE	%/yr	12	55	8908	w MN 1969-85	NS	H1 and H2 models of Brownie et al. 1985.
	J	M	-	FA	49.7	2.2 SE	%/yr	32	66	18553			
	A	F	-	FA	42.0	1.8 SE	%/yr	15	64	9129			
	J	F	-	FA	48.4	2.8 SE	%/yr	27	56	17570			
Chu & Hestbeck 1989	A	M	-	FA	33.8	1.2 SE	%/yr	16	56	15765	ND 1969-85	NS	H1 and H2 models of Brownie et al. 1985.
	J	M	-	FA	29.8	4.7 SE	%/yr	15	49	3613			
	A	F	-	FA	40.5	3.2 SE	%/yr	10	62	7373			
	J	F	-	FA	33.8	6.8 SE	%/yr	10	68	3463			

Reference	Age	Sex	Cond	Seas	Mean	SD/SE	Units	Minimum	Maximum	N	Location	Habitat	Notes
Chu & Hestbeck 1989	A	M	-	-	32.7	0.9 SE	%/yr	8	54	18289	n CA 1971-85	NS	H1 and H2 models of Brownie et al. 1985.
	J	M	-	-	46.1	2.3 SE	%/yr	28	65	11372			
	A	F	-	-	45.5	1.3 SE	%/yr	26	64	13704			
	J	F	-	-	43.7	4.5 SE	%/yr	16	78	8205			
Chu & Hestbeck 1989	A	M	-	FA	39.0	2.3 SE	%/yr	9	60	4097	ne US 1971-85	NS	H1 and H2 models of Brownie et al. 1985.
	J	M	-	FA	48.1	5.3 SE	%/yr	7	69	10103			
	A	F	-	FA	51.5	1.9 SE	%/yr	33	64	4596			
	J	F	-	FA	56.8	3.2 SE	%/yr	38	68	9890			
Kirby & Cowardin 1986	A	B	-	-	37.2		%/yr				n c Minnesota 1968-74	NS	
	J	B	-	-	54.5		%/yr						
Lee et al. 1964	J	-	-	-	71		%/yr				Minnesota	NS	As cited in Bellrose 1976.
	A	-	-	-	56		%/yr						
Lokemoen et al. 1990a	J	B	-	-	32		%/yr				c N Dakota 1976-81	prairie potholes	Calculated mortality from hatching to near fledging.

***** SEASONAL ACTIVITIES *****

Reference	Begin	Peak	End	Location	Habitat	Notes
MATING/LAYING						
Bellrose 1976		May		CA,UT,MT,SD, NY,VT	NS	
Krapu & Doty 1979	Apr 4	May 3	Jul 17	s c N Dakota	NS	Total of 265 nests. Median date of nest initiation by adults was 7 days earlier than for yearlings.
Lokemoen et al. 1990b	late Apr	mid May	mid Jun	c N Dakota	prairie potholes	Time of nest initiation.
HATCHING						
Toft et al. 1984		June		NW Terr., CAN	wetlands	
FALL/BASIC MOLT						
Fredrickson & Heitmeyer 1988	mid Sept		Nov	Mississippi Valley	forested wetlands	Prealternate molt.
Fredrickson & Heitmeyer 1988	Dec		Mar	Mississippi Valley	forested wetlands	Prebasic molt.

Reference	Begin	Peak	End	Location	Habitat	Notes
Heitmeyer 1988a		mid Oct	late Nov	se Missouri 1980-83	lowland hardwood wetlands	
FALL MIGRATION						
Fredrickson & Heitmeyer 1988	mid Sep	Oct	earl Nov	Mississipi Valley	forested wetlands	Arrival of mallards to the upper Mississippi Alluvial Valley.
Palmer 1976	late Sep		Nov	Canada	NS	Leaving prairie provinces.
Palmer 1976	mid Oct	Nov		northern US	NS	Leaving northern third of US breeding areas.
Palmer 1976	mid Oct	Dec		mid-central US	NS	Leaving mid-central US breeding areas.
Rutherford 1966	mid Sep	mid Nov		Colorado	high plains	Arrival of wintering mallards. As cited in Ringelman et al. 1989.
SPRING MIGRATION						
Fredrickson & Heitmeyer 1988		mid Mar		Mississipi Valley	forested wetlands	Departure of mallards from the upper Mississippi Alluvial Valley.
Johnson et al. 1987	Mar 15		May 10	n c US	prairie potholes	Arrive on breeding grounds.
Lokemoen et al. 1990b	late Mar	mid Apr	mid May	c N Dakota	prairie potholes	Arrival of females on breeding grounds; second-year hens arrived significantly later than after-second-year hens.
Palmer 1976	late Mar	Apr		arrive Canada	prairie potholes	
Rutherford 1966		earl Mar		Colorado	high plains	Departure of wintering mallards. As cited in Ringelman et al. 1989.